Yeshiva University - Office of Admissions
yuadmit@yu.edu
212-960-5277

Women in Science | Yeshiva University STERN COLLEGE FOR WOMEN | Volume XIV

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Student Co-editors

Ilana Karp
Tzivia Linfield

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Introductory Remarks

The Departments of Biology, Chemistry/Biochemistry, Computer Science, Mathematical Sciences, Physics, Psychology, and Speech Pathology/ Audiology each unique in its specific discipline, share a proactive approach in promoting the academic success of students at Stern College for Women (SCW) and in helping them achieve their career goals. The spectrum of career choices in the biomedical, health, natural sciences, physical sciences, and behavioral sciences is varied, with our students entering graduate programs in medicine, dentistry, osteopathy, optometry, veterinary science, psychology, physical therapy, occupational therapy, physician assistant, nursing, genetic counseling, pharmacy, nutrition, speech pathology/audiology, education, social work, and law; masters programs in biotechnology, bioethics, public health, engineering, architecture, and bioinformatics; and doctoral programs in the biomedical sciences, chemistry, physics, neuropsychology, clinical psychology, and school psychology. Education in biology, chemistry, physics and engineering sciences are stepping stones toward careers in research and education in technology-oriented fields, including nanoscience and nanotechnology.

The Departments of Biology, Chemistry and Biochemistry, Computer Science, Mathematical Sciences, Physics, Psychology, and Speech Pathology/ Audiology direct students to stretch beyond the classroom experience by involvement in scientific research. Both in the academic year and in the summer, students may work one-on-one with on-campus faculty. In the Summer, 2011, a collaborative interaction between Bar Ilan University and Yeshiva University enabled SCW and Yeshiva College (YC) undergraduates to intern in research laboratories in Bar Ilan University and, thereby, to spend a summer in Israel. In the summer 2018, 13 SCW undergraduates participated in this summer laboratory experience, now termed the Bar Ilan Summer Research Program. The science faculties actively encourage the science majors to apply for competitive undergraduate research internships, locally, nationally, and internationally. In the summer of 2018, an additional 50 SCW students were involved in research in a variety of laboratory facilities, including on-campus at SCW and Yeshiva College, and at The Rockefeller University, Albert Einstein College of Medicine (AECOM), Montefiore Medical Center, New York University, Memorial Sloan-Kettering Cancer Center, Columbia University Medical Center, Feinstein Institute for Medical Research, Mt. Sinai School of Medicine, Peters VA Medical Center Spinal Cord Damage Research Center, University of Colorado Medical School, National Institutes of Health, and Sunnybrook Research Institute (Toronto), as well as in the Health Careers Opportunity Program at the Rusk Institute for Rehabilitative Medicine. Undergraduates majoring in computer science received summer internships at AECOM (SERC Scholar), the Bar Ilan-YU summer research program, Palantir, Goldman Sachs, Nomura Bank, Brookville Advisory, Google, Facebook, Tifany & Co., Microsoft Data Science Summer School, and UBS Bank. Sarah Gulkowitz was the recipient of the VIP Women in Technology Scholarship for the 2018-2019 academic year.

The Jewish Foundation for the Education of Women (JFEW) Science Fellowship Program was inaugurated in the 2009-2010 academic year, with ten participating students. Each subsequent year, an additional cohort of students, all with interests in the sciences, joined the Program. The 2017-18 academic year marked the first in which the JFEW Program was expanded to support a select group of both science and liberal-arts-focused students, through the 2021 academic year. Highlights of the JFEW Science Fellowship Program include a partial scholarship, a stipend for a summer research internship as well as travel funds, a stipend to support scientific conference attendance, one-on-one mentoring with a science faculty member, and an enrichment program, providing workshops to aid students in their academic and professional development. In addition, the JFEW Program provides an internal network with both current students and graduates. Since its inception, JFEW Fellows have obtained internships, either in clinical or biomedical wet-lab research, in fields of research including psychology, cancer cell biology, veterinary medicine, neurobiology, healthcare, and molecular biology. The Fellows have interned in prestigious institutions, including University of Chicago, Emory University, AECOM, The Rockefeller University, Johns Hopkins University, Harvard Medical School, Rutgers University, New York University, Yale University, Barrow Neurological Institute, Hadassah Hospital, Bar Ilan University, Tel Aviv University, and in industry, Citromax. Several of the JFEW students have taken leadership roles in forming and/or leading the Neurobiology Club, the Genetics Club, the Optometry Club, and the Medical Ethics Society. Graduates of the Program are currently pursuing careers in various science and health-related fields: medicine, dentistry, physical therapy, occupational therapy, nursing, public health, biomedical engineering, math education, food science, psychology, and veterinary medicine.

The Department of Mathematical Sciences owes to the illustrious tradition in mathematics and physics at Yeshiva University, whose notable alumni and former faculty include Paul Dirac, Roger Penrose, Freeman Dyson, and Hillel Furstenberg. Today's B.A. program, M.A. program, and Ph.D. program, continue offering a high-class education, providing preparation for careers in technology, finance, economics, business, or academia. A personalized curriculum, integrated research and training, and one-on-one mentoring are keys for our students' success. We also offer a
a variety of enrichment activities at SCW, including the math club "No Limits", and citywide seminars in Dynamical Systems and/or Mathematical Physics. Graduates of our programs have been employed by Google, Goldman Sachs, Citigroup, Merrill Lynch, Bank America, or pursued advanced degrees at Harvard, Yale, MIT, Princeton, Columbia, or New York University.

The mission of the Department of Computer Science is to prepare students for employment in various fields of computer science and/or to pursue advanced studies in computer science. In addition to covering fundamentals of Computer Science theory and practice, department courses help students maximize their

portfolios of significant coding projects. The courses are structured to expose students to a variety of programming languages in a broad range of application areas. Students who complete this program should be well versed in the disciplines of object oriented design and development, the architectures of software and hardware systems, the theory and practice of programming language technology, the construction and use of data structures and algorithms for the solution of large-scale computing problems, and the theory and application of database systems. There is a strong emphasis in the Department on preparation for challenging jobs in industry – our faculty and adjuncts come from positions of intensive industrial experience and leadership. Students in the department are involved in Computer Science outside the classroom – through an active ACM-W chapter, by participating in regional and national hackathons, and by working in internships at well-known firms such as Google, Facebook, Microsoft, Palantir, Goldman Sachs, and many others. Honors students in our program work with faculty on computational research projects, preparing them for graduate level work, and/or prime industrial positions.

The Department of Psychology offers an Honor's Research Seminar for upper-level psychology majors. As part of this seminar, students are involved in ongoing research projects, either at SCW or at off-campus sites, such as the Ferkauf Graduate School, NYU Medical Center and Mt. Sinai School of Medicine, among others, and are supervised by an on-site investigator for 6 hours/week for 12 weeks. The primary requirement for the course is a comprehensive literature review and/or scientific report of the students' research projects, as well as a class presentation. The combination of internship and seminar allows the students to gain practical experience in literature review, data collection and management, and scientific writing and oral presentations. Students attending graduate programs in Clinical Psychology have identified the research seminar as being particularly helpful in preparing them for graduate school.

To meet growing student interest in the neurosciences, programs in neurobiology were instituted by a collaborative interaction between the Department of Psychology and the Department of Biology. In these programs, students complete a prescribed combination of courses in biology and in psychology (with each Department emphasizing its own requirements) and upon successful completion of the program, the designation "concentration in the neurosciences" is included on the college transcript.

The Speech Pathology/Audiology Department provides the academic and pre-clinical experiences to begin graduate studies, either for an M.S. in speech pathology or a Ph.D. in audiology. As part of the "extra-curricular" activities of the Department, students edit, manage and publish a journal, reflecting either a unique research project or a literature review. The topics include speech language pathology, audiology, or speech and hearing science. Some students participated in a research project involving dysphagia and dysphonia

associated with anterior cervical spine surgery. These students were part of a project conducted at the North Shore Hospital, reviewing patient data and research materials. The Speech Pathology/Audiology Club hosted renowned professionals to address clinical experiences, research projects, and career issues.

A specific objective of the science departments at SCW, in addition to nurturing the highest level of academic achievement, is to provide students with opportunities for leadership roles. Upper-level students may be appointed to positions as Teaching Assistants (TAs) for laboratory sections and as Recitation Instructors to review materials for the lecture sections of the science courses. Student-led clubs, such as the Biology Club, the Chemistry Club, the Physics Club, the Psychology Club, the PreMed Club, the PreDent Club, the Occupational Therapy Club, the Pharmacology Club, the Nutrition Club, the Global Health Club, Pre-Engineering Club, the Nutrition Club, the Bikur Cholim Club, *etc*., provide opportunities for students to gain skills in organizing events and in coordinating social functions. The 2010-2011 academic year saw the birth of four new clubs, the Nursing Club, the Genetics Club, the Optometry Club, and the Neuroscience Club. The Public Health Club was launched during the 2011-2012 academic year; beginning in the fall semester 2016, the college instituted a minor of public health. Our newest club, the Physician Assistant Club, was started in the 2012-2013 academic year in order to spur interest in an increasingly popular field. These clubs often invite outside speakers to lecture and to conduct question-and-answer sessions on a variety of interesting topics. The Nursing Club held a number of particularly well-attended events, including an information session with admissions officers from the nursing programs at NYU, Columbia University, and Pace University. It also organized a guided tour of the NYU College of Nursing. These student-run clubs provide students with the opportunity to develop the social and professional skills needed to succeed in their future careers and provide networking opportunities with Stern College alumni already in the field.

SURGE, the Student Undergraduate Research Group Exchange, is a faculty-sponsored, student-led club that gives students the forum to present their research as a seminar before their colleagues and the science faculty. The goals of this faculty-initiated club are to encourage and foster research and the exchange of research information. Meetings are held once a month, usually with two or three students presenting PowerPoint professional seminars. Faculty members also use these meetings to inform students of upcoming internships and fellowship opportunities. In the 2016-2017 academic year, the following students presented seminars at SURGE meeting:

FALL 2017, SURGE Meetings		
October 2017		
Name	**Research Title**	**Program/Location**
Jennifer Gardner	Molecular Mechanisms of Neurogenesis in the Hippocampal Dentate Gyrus	Bar Ilan University
Lea Lefkowitz	"The Effects of Abiotic Stress on *Arabidopsis thaliana*"	Bar Ilan University
Stephanie Roffe	M-280 Dynabeads Treatment Optimization	Bar Ilan University
November 2017		
Name	**Research Title**	**Program/Location**
Chana Bushee	Procoagulant Platelets in Thrombosis	Blood Research Institute at the Blood Center of Wisconsin
Avigail Goldberger	LRP6 Antibody Inhibits Tumor Growth and Metastasis in Breast Cancer Mouse Models	Yeshiva College
Neda Shokrian	Cloning and Protein Expression of LOXL1 in Cells	Columbia University Medical Center
December 2017		
Name	**Research Title**	**Program/Location**
Allison Schachter	Pediatric Delirium in the PACU	Weill-Cornell
Shanie Kahan	A Novel Bioorthogonal Trans-synaptic Tracer of Neural Circuitry	Stony Brook University
Tzivia Linfield	ANGPTL4 Promotes Lymphangiogenesis in Head and Neck Squamous Cell Carcinoma	University of Maryland
SPRING 2018, SURGE Meetings		
March 2018		
Name	**Title**	**Research Program or University**
Goldie Wolfson	Endocannabinoid Anandamide (AEA) Suggests Possible Decrease on Biofilm Density	Hebrew University
Malka Racheli Topp	Improving Efficacy of Gene Editing with CRISPR	Bar Ilan University
April 2018		
Name	**Title**	**Research Program or University**
Gaalia Strupinsky	The Evolution of the H1N1 2009 Pandemic Influenza A Virus	Icahn School of Medicine at Mt. Sinai Hosp.
Allison Schachter	Off Label Drug Usage in Critically Ill Children	Weill Cornell Medical College

Each Fall semester, the science departments jointly sponsor a poster presentation contest. Students present their work and discuss the research with attending faculty. The posters, and more importantly the student's understanding of the project and the extent of her hands-on participation, are evaluated by the science faculty. Winners are selected to present at a national meeting of the American Chemical Society. The costs of attending the meeting, including transportation and hotel, are underwritten by the Dean's Office, SCW, and by faculty research grants. In the Spring semester of 2018, Lior Levy (poster title**,** "mTOR inhibition increases lifespan in Li-Fraumeni Syndrome fibroblasts by positively influencing the DNA damage response") and Tzivia Linfield (poster title, "ANGPTL4 Promotes Lymphangiogenesis in Head and Neck Squamous Cell Carcinoma") at the 255th National Meeting of the American Chemical Society, New Orleans, LA, April. The SCW Chemistry Club, a student affiliate chapter of the American Chemical Society (ACS), has been awarded a Community Interaction Grant for the 2018-2019 academic year. A committee of faculty advisors reviewed the submitted proposals and the SCW Chemistry Club was the one to receive funding. The proposal, a continuance of an outreach activity at an elementary NYC public school on the Lower East Side, was put together by an incoming board member, Neda Shokrian. The opportunities offered by the undergraduate programs office of the ACS provide our students with invaluable experience in proposal writing, budget allocation, and grant reporting activities.

SCW graduates attending AECOM for their medical education are eligible to apply for Anne Scheiber Fellowships. This unique award provides up to full tuition scholarships based on need for four years of medical training (see "Anne Scheiber Fellowship").

Students considering careers in the various allied health fields (for example, occupational and physical therapy) or in engineering may wish to consider one of our several combined degree programs with other universities. In the spring term of 2009, Yeshiva University entered into a cooperative agreement with the NYU Steinhardt School of Culture, Education, and Human Development, designed to expand opportunities for students to prepare for a career in teaching math and science at the elementary and high school levels. During the fall of 2012, Stern College signed an articulation agreement to implement a combined program with the NYU College of Nursing. Students interested in this program pursue a shaped major that leads to the completion of the necessary prerequisites within five semesters for those who study for a year abroad in Israel (or seven semesters for those who come directly to Stern College after high school). If they are accepted to the program, they will receive a B.A. from Stern College upon completion of their first semester at the NYU College of Nursing. Once they have successfully completed the 15-month accelerated program at NYU, they will be awarded a BSN from their nursing school. This exciting new program has already admitted two classes of SCW students and should be the basis of a productive and long-term partnership between Stern College and the NYU College of Nursing" (see "Combined Programs"). The largest class yet, with 16 admitted students, entered NYU via the joint program in January, 2016.For students interested in

nutrition, a shaped major option exists. Students in their senior year may take up to 12 credits in approved nutrition courses at NYU towards their shaped major. These courses will also count toward the DPD sequence requirements at NYU should the student continue in that program after completing her BA degree.

An important focus of SCW is to educate the next generation of Jewish women for leadership positions in their professions and communities. Our commitment to the YU mission of *Torah U'Madda* is mirrored in the daily lifestyles of our students and thereafter in their future roles as professionals. Stern College students have academic strengths in both general and Jewish studies; the fusion of these worlds is evident in the student publication, *Derech HaTeva, a Journal of Torah and Science*. This SCW publication is distributed nationally and internationally and has received much praise for its level of Torah/science scholarship (see "*Derech HaTeva,*" for a listing of articles that appeared in volumes 1 through 22).

Specific faculty members are assigned roles to provide an intensive involvement in guiding students with their career choices and specifically in assisting with the application process. Dr. Brenda Loewy, director of the Office of PreHealth Advisement, has recently been joined by Dr. Chaya Rapp, to assist those students interested in careers in medicine, dentistry, optometry, veterinary medicine, and pharmacy. Mr. Jeff Mollin's focus is those students interested in careers in physical therapy, occupational therapy, physician assistant, and nursing and Dr. Harvey Babich assists those interesting in a career in genetic counseling.

In the Fall semester, 2012, SCW alumni, now medical students in AECOM, initiated The Stern-Einstein Mentorship Program (affectionately known as the "Big Sister Mentor Program"). The intent of this program was to connect pre-med or pre-health undergraduates with SCW alumni at AECOM, who will guide the undergraduates in the medical school application and interview processes, as well to be available to answer simple questions that will save time and prevent unnecessary frustration. This program is now beginning its fourth year and has met with much success.

Dr. Loewy organized several seminars in which the guest speakers provided valuable insights into the various professions, as well as information on the admissions process to their graduate and professional programs. This past year, the SCW and Yeshiva College (YC) pre-med clubs organized the annual Medical School Fair in which admission directors and officers from allopathic and osteopathic medical schools, as well as from American medical student programs in Israel, attended. The location of the annual fair is alternated between the Wilf Campus (YC) and Beren Campus (SCW); this past year it was held at the Wilf Campus. Each medical school had its own booth, thereby allowing students to approach the representative and to ask questions and gain insight into the school. The following schools were present at the fair: representing the American Allopathic Medical Schools were Hofstra, Cornell,

Quinnipiac, and Jefferson the Commonwealth Medical College; representing the American Osteopathic Medical Schools were Philadelphia College of Osteopathic Medicine and Rowan University School of Osteopathic Medicine; representing the Israel American Medical Student Programs were Sackler, Technion, and Ben Gurion. Also in attendance were Touro College of Pharmacy and New York College of Podiatric Medicine.

In the 2011-2012 academic year, Dean Karen Bacon initiated the “Deans' Scholars Academic Enrichment Program.” This Program offers those outstanding students in Yeshiva University's undergraduate schools an opportunity to participate in one of three cooperative programs. The program of particular interest to science majors is the “Frontiers in Biomedical Science: Theory and Practice.” This project is under the direction of Dr. Edward Burns, Executive Dean of the Albert Einstein College of Medicine. The seminar meets six Fridays during the semester at AECOM and features leading biomedical scientists and their research. A second program, “Frontiers in Contemporary American Law," is under the direction of Vice Dean Melanie Leslie of Yeshiva University’s Benjamin N. Cardozo School of Law. This exciting enrichment program meets at Cardozo School of Law six Fridays during the Spring semester for two hour sessions and is led by Cardozo faculty. Scholars discuss the ways that the U.S. legal system resolves disputes and addresses fundamental questions of justice through legal reasoning and processes. The third program is Frontiers in Psychology. This enrichment program, organized in conjunction with Dean Lawrence Siegel of Yeshiva University’s Ferkauf Graduate School of Psychology, is an undergraduate program at the Ferkauf Campus. Scholars attend two-hour Friday seminars six times during the semester, led by Ferkauf faculty during the Fall semester on campus. The program aims to expose students to a spectrum of fields and specialties within psychology and to show students how the field’s practitioners evaluate and address current societal issues using the science of psychology.

Department of Biology

Faculty: Anya Alayev, Ph.D.; Levy Amar, Ph.D.; Harvey Babich, Ph.D.; Bill Bassman, M.S.; Amanda Katz, Ph.D.; Stav Kemeny, Ph.D.; Brenda Loewy, Ph.D.; Jeffrey Mollin, M.Phil.; Jennifer Odien, Ph.D.; Alyssa Schuck, Ph.D.; Margarita Vigodner, Ph.D.; Richard Weiss, M.D.

The Department of Biology offers a wide range of courses providing students with a thorough grounding in the fundamentals of modern biology, as well as exposing them to the cutting-edge areas of biomedical research. Course offerings include Cell Biology, Genetics, Human Anatomy, Human Biology, Human Development, Human Physiology, Immunology, Medical Biochemistry, Microbiology, Molecular Biology, Neurobiology, Nutrition, Pharmacology, Kinesiology, and Reproductive Biology, as well as Journal Club.

The B.A. in biology offered by the Biology Department requires completion of Principles of Biology I and II and 20 credits of advanced courses in Biology, of which four of the courses must be 4-credit lecture/laboratory courses. Also offered by the Biology Department are rigorous programs focusing on a concentration in neurosciences and a concentration in cell and molecular biology. Upon completion of the appropriate course of study, the phrase "concentration in the neurosciences" or "concentration in cell and molecular biology" is noted on the transcript. To accommodate the science requirements for non-science majors, the 4-credit course, Human Biology, lecture with laboratory, was introduced into the college curriculum.

Exciting one credit **Journal Club** courses are offered. As of the Spring semester, 2015, Journal Clubs courses were taught by Stern alumni, either 4th year med students at Albert Einstein College of Medicine (AECOM) or doctoral students in the Ph.D. program at Sue Golding Graduate Division of Biomedical Sciences, AECOM. The title of the Journal Club taught in the Fall semester, 2018, "Preventive Medicine," is led by Sarah Mizrachi and Michelle Haimowitz. In the Spring semester, 2018, Shira Marder and Sarah Noble taught the Journal Club entitled "Women's Health: Epidemiology Studies." "Oncology," was the topic of the Journal Club offered in the Fall term, 2016, and was taught by Rikah Lerer and Miriam Steinberger. In the Spring semester, 2015, the topic of the Journal Club was "Immunology and Disease," taught by Hadassa Klerman, Jennifer Deluty, and Elisa Karp. In the Fall semester, 2015, Dr. James Nussbaum, Ph.D., P.T., instructed the Journal Club entitled, "Human Gait." This Journal Club was directed specifically to pre-PT and pre-OT students; in the Fall semester, 2014, he taught the Journal Club "Biomechanics."

In the Fall semester, 2018, Dr. Dana Lotan, PTD, a SCW alum and a PT with the Rusk Institute for Rehabilitative Medicine, instructs the 2-credit course, Kinesiology. Neurobiology (lecture with a laboratory) and Immunology

(lecture with a laboratory) are scheduled to be offered in the Spring semester, 2019.

The Department of Biology welcomes two new adjunct faculty who are joining as of the Fall semester, 2018. Dr. Amanda Katz, Ph.D., earned her doctorate in cancer biology from the Weill Cornell Medical College, Graduate School of Medical Sciences. The topic of her thesis was, "The role of tumor-associated astrocytes in PDGF-driven glioma. SCW is proud of Dr. Katz's accomplishments, as she is a graduate of SCW. Also, we welcome Dr. Stav Kemeny, who earned her doctorate in molecular biology from the Technion - Israel Institute of Technology. Dr. Kemeny has extensive research in neurodegenerative diseases.

Dr. Brenda Loewy, a faculty member of the Biology Department and the recipient of the 2008, Dean Karen Bacon Award for a Senior Faculty Member, is the college's Pre-Health Advisor. Her directive is to guide students interested in medicine, dentistry, optometry, and podiatry through the application process. To accomplish these goals, Dr. Loewy organizes a series of wide-ranging seminars. The overwhelming number of students interested in medicine, dentistry, and optometry, necessitated the recruiting of Dr. Chaya Rapp, Department of Chemistry and Biochemistry, to join the **Office of Pre-Health Advisement**. An important addition to the pre-health advisement staff was the appointment of Mr. Jeffrey Mollin, a member of the Biology Department, to guide students with career goals in nursing, physical therapy, occupational therapy, and physician assistant. Mr. Mollin was the recipient of the 2017 Dean Karen Bacon Award for a Senior Faculty Member. Dr. Harvey Babich guides those undergraduates interested in a career as a genetic counselor. Dr. Alyssa Schuck, faculty member of the Biology Department, heads the **Jewish Foundation for Education of Women** (JFEW) Science Fellowship and guides students participating in this program. Dr. Schuck was selected as the Senior Class Professor of the Year, 2013, 2014, 2016, and 2018. In 2016, Dr. Schuck received the Dean Karen Bacon Faculty Award.

Volume 22 of *Derech HaTeva. A Journal of Torah and Science*, was published in the Spring semester, 2017. This issue included manuscripts authored by 16 undergraduates, as well as the article, "Environmental pollution in the Ta'nach and in the Talmud," authored by Dr. Babich. In the 2017-2018 academic year the Biology Department hosted a series of ***Torah U'Madda*** presentations, including talks by Rabbi Gideon Weitzman, Director of the Puah institute, on the topic "Procreation and playing God: have we gone too far?" and by Ms. Leah Fried, a genetic counselor, on the topic "When genetic information and ethics clash." The Yeshiva University Medical Ethics Society hosted the talk, "Practical medical *halacha*; questions and answers," led by Rabbi Dr. Howard Apfel, a cardiologist at Columbia Medical Center and the Rabbi at Torah Shraga.

Dr. Levy Amar, a relatively new full-time biology faculty member, initiated the Emergency Medical Technician Training Program for pre-health SCW and Yeshiva College (YC) undergraduates, along with the formation of the SCW-

EMS and the YU-EMS. An $8,000 scholarship is awarded to students in need of financial assistance.

Dr. Margarita Vigodner, an Associate Professor of Biology, and Dr. Anya Alayev, a Clinical Assistant Professor of Biology, have put the Biology Department on the "research map," as attested by their record of **publishing scientific research manuscripts** in prestigious scientific journals. Dr. Vigodner holds a secondary appointment at the rank of Assistant Professor in the Developmental and Molecular Biology at AECOM.
Dr. Vigodner's past **research support** included the NIH, NICHD: Academic Research Enhancement Award 1R15HD067944-01A1; "Regulation of Spermatogenesis by sumoylation;" extended until 1/11/2015 as an NIH; NICHD Administrative Supplements to Recover Losses Due to Hurricane Sandy. Through support by the Mitrani Foundation, in the Summer, 2015, the Vigodner laboratory was fully renovated. In addition, the Mitrani Foundation provided a small grant to support student research.

Dr. Schuck, whose research interests involve the response of human oral cancer cells to nutraceuticals, as well as Drs. Vigodner and Alayev, actively recruit SCW undergraduates to join their research. The focus on cutting-edge research by the Biology faculty has been the driving force in the publication of numerous manuscripts in peer-reviewed scientific journals.

Below is a list only of faculty-generated manuscripts with a publication date of 2017 and later.

Schafler, E.D., Thomas, P.A., Ha, S., Wang, Y., Bermudez-Hernandez, K., Tang, Z., Fenyo, D., **Vigodner, M.,** and Logan, S.K., 2018, UXT is required for spermatogenesis in mice, *PLos One* 132:e0195747.

Bostner, J., **Alayev, A.,** Berman, A.Y, Fornander, T., Nordenskjöld, B., Holz, M.K. and Stål, O., 2018, Raptor localization and estrogen-dependent breast cancer growth. *Breast Cancer Res Treat.* 168:17-27.

Berman, A.Y., Manna, S., Schwartz, N.S., Sun, Y., Yu, J.J., Behrmann, C.A., Plas, D.R., **Alayev, A.,** and Holz, M.K., 2017, ERRα regulates the growth of triple-negative breast cancer cells via S6K1-dependent mechanism. *Signal Transduct Target Ther*. 2. *pii: e17035.*

Li, C., Liu, Y., Zhang, E., Sun, Y., Li, N., Medepalli, K., Wikenheiser-Brokamp, K., Plas, D.R., Sun, J., Chen, Y., Franz, D.N., Capal, J.K., Mays, M., Kwiatkowski, D., **Alayev, A.**, Holz, M.K., Kruger, D., Siroky, D. and Yu, J.J., 2017, Tuberin regulates prostaglandin E receptor 3-mediated viability of mTORC1-hyperactive cells via Rheb. *Mol Cancer Res*. 15:1318-1330.

Alayev, A., Salamon, R.S., Schwartz, N.S., Berman, A.Y., Wiener, S.L., Holz, M.K., 2017, Combination of rapamycin and resveratrol for treatment of bladder cancer. *J Cell Physiol*. 232:436-446.

Xiao, Y., Lucas, B., Molcho, ER., Schiff, T., and **Vigodner, M.,** 2017, Cross talk between sumoylation and phosphorylation in mouse spermatoctes, *Biochem. Biophys. Res. Commun.* 487:640-645.

Li, C., Liu, Y., Zhang, E., Sun, Y., Li, N., Medepalli, K., Wikenheiser-Brokamp, K., Plas, D.R., Sun, J., Chen, Y., Franz, D.N., Capal, J.K., Mays, M., Kwiatkowski, D., **Alayev, A.**, Holz, M.K., Kruger, D., Siroky, D. and Yu, J.J., 2017, Tuberin regulates prostaglandin E receptor 3-mediated viability of mTORC1-hyperactive cells via Rheb. *Mol Cancer Res*. 15:1318-1330.

Amar, L., Thong, E., Hill, M., Van Rijn, C., 2018, Modeling of fouling in cross-flow microfiltration of suspensions, *ACS Applied Materials & Interface.* (under review).

Drs. Vigodner and Amar presented their research at meetings of national and international societies, as well as before learned audiences. Below are some of these presentations (2016-2017).

Dr. Vigodner:
2017 Cross talk between sumoylation and phosphorylation in mouse spermatocytes, American Society of Andrology, Miami, FL (April)

Dr. Amar:
2017 Reversing aging through regenerative medicine, Biomedical Engineering Seminars – Columbia University, February 3.

Some undergraduates participate in research in external laboratories and, when their contributions were significant, their names are included as coauthors on the research papers and on abstracts. Names of such undergraduates are in bold type.

Girdhar, K., Hoffman, G.E., Jiang, Y., Brown, L., Kundakovic, M., Hauberg, M.E., Francoeur, N.J., Wang, Y.C., Shah, H., Kavanagh, D.H., Zharovsky, E., **Jacobov, R., Wiseman, J.R**., Park, R., Johnson, J.S., Kassim, B.S., Sloofman, L., Mattei, E., Weng, Sieberts, S.K., Peters, M.A., Harris, B.T., Lipska, B.K., Sklar, P., Roussos, P.Z., and Akbarian, S., 2018, Cell-specific histone modification maps in the human frontal lobe link schizophrenia risk to the neuronal epigenome, Nat. Neurosci. 21:1126-1136.

Pereira, A.C., Gray, J.D., Kogan, J.F., **Davidson, R.L.**, Rubin, T,, Morrison, J.H., and McEwen, B.S., 2017, Age and Alzheimers's disease gene expression profiles reversed by glutamate modulator riluzole, Molecular Psychiatry, 22:296-305.

Yu, T.S., Tensaouti, Y., Bagha, Z.M., **Davidson, R.L.**, Kim, A., and Kernie, S.G., 2017, Adult newborn neurons interfere with fear discrimination in a protocol-dependent manner, Brain Behavior, 7(9):e00796.

Koppel, A., Ranasinghe, O., Navarathna, M., Coors, C., Abeyweera, N., Codipilly, C., and Schanler, R., 2018, Acidic human milk fortification does not enhance probiotic growth in human milk. Poster presentation, Pediatric Academic Societies Meeting, Toronto, Canada, May.

Codipilly, C., **Koppel, A.,** Navarathna, M., Ranasinghe, O., Coors, C., Abeyweera, N., and Schanler, R., 2018, Milk fat globule epidermal growth factor 8 (MFG-E8) in preterm human milk. Poster presentation, Pediatric Academic Societies Meeting, Toronto, Canada, May.

Codipilly, C., Navarathna, M., **Koppel, A**., Brewer, M., Maffei, D., Ranasinghe, O. and Schanler, R., 2018, Detection of milk fat globule epidermal growth factor 8 (MFG-E8) in intestinal secretions of preterm infants. Poster presentation, Pediatric Academic Societies Meeting, Toronto, Canada, May.

Levy, L., Kafri, R., and Malkin, D., 2018, mTOR inhibition increases lifespan in Li-Fraumeni Syndrome fibroblasts by positively influencing the DNA damage response, 255th National Meeting of the American Chemical Society, New Orleans, LA, March.

Linfield, T., Park, H. E., Menon, D., and Montaner, S., 2018, ANGPTL4 promotes lymphangiogenesis in head and neck squamous cell carcinoma, 255th National Meeting of the American Chemical Society, New Orleans, LA, March.

Gerber, N., Dubrovsky, E., Lowe, S., Brodsy, A., Kurz, E., **Marmer, M.,** Chun, J., Schwartz, S., Shapiro, R., Axelrod, D., Guth, A., and Schnabel. F., 2017, DCIS on core-needle biopsy with no residual disease at surgery, SSO Annual Cancer Symposium, WA, March

Levy, L., Chernichovski, T., and Schwartz, I., 2017, Male sex hormones regulate human endothelial nitric oxide synthase system through the modulation of cationic amino acid transporter-1, 253rd National Meeting of the American Chemical Society, San Francisco, CA, April.

Saffern, M.S., Abt, M.C., and Pamer, E.G., 2017, Role of IL-17a in fecal microbiota transplant mediated clearance of *C. difficile* infection, 253rd National Meeting of the American Chemical Society, San Francisco, CA, April.

Off-campus research placements abound, with SCW students obtaining **research internships** during the 2017-2018 academic year at The Rockefeller University, Mount Sinai School of Medicine, and New York University Medical Center. Summers are a prime time for research. In the Summer, 2018 our students have participated in the Bar-Ilan University summer research program, as well as in interning in Albert Einstein College of Medicine, Montefiore Medical Center, Memorial Sloan-Kettering Cancer Center, NYU School of Medicine, Peters VA Medical Center Spinal Cord Damage Research

Center, Columbia University Medical Center, National Institutes of Health, University of Colorado Medical School, Rice University, Ohio State University Wexner Medical Center, Sunnybrook Research Institute (Toronto, Canada), Albert Einstein Hospital (San Paolo, Brazil), and the Rusk Institute for Rehabilitative Medicine.

The Department of Biology has upgraded the infrastructure of the on-campus research laboratories. Beginning in the Summer, 2011, and extending into the Fall semester, the on-campus research laboratory (room 341 of 253 Lexington Avenue) was renovated and modernized through a $100,000 grant from the Elias, Genevieve, and Georgiana Atol Charitable Trust. This expansion and upgrading of the laboratory accounted, in part, for attracting our students to on-campus research opportunities. In the Summer, 2014 and continuing into the Fall, 2014, through a grant of $200,000 from the Selma T. and Jacque Mitrani Foundation, renovations and modernization of the on-campus male infertility research laboratory of Dr. Vigodner (room 347of 253 Lexington Avenue) commenced. Such renovations and modernizations will allow Dr. Vigodner to upgrade her research operation to further provide opportunities for undergraduate research and to further increase her effectiveness in procuring external funding.

Aware of the need to maintain state-of-the-art scientific technology, the Department of Biology constantly upgrades the equipment used in the teaching laboratories and in the on-campus research laboratories. Through the generosity of the Joseph Alexander Foundation, a Beekman-Coulter Z2 Cell Counter and XCell Surelock Mini Cell with XCell II Blot module, used for western blotting, was purchased in the 2016-2016 academic year. During the 2013-2014 academic year the following items were purchased: Sorvall RC6plus centrifuge, Eppendorf mini-centrifuge, Eppendorf refrigerated mini-centrifuge, Millipore water purification system, Evos fluorescent microscope, heat block, water bath, power supplies, and shaker. Funding from grants were directed to the purchase of an environmental chamber for the Evos fluorescent microscope (used for live cell imaging). An inverted microscope with the capacity to photograph living cells was purchased in 2013 for use in the on-campus research laboratory co-occupied by Drs. Schuck and Babich. During the 2011-2012 academic year, the Biology Department purchased two PhotoDoc-It Imaging Systems, to photograph DNA gels, for use in the teaching laboratories and a BioTek Synergy HT Microplate Multimode Microplate Reader for use in research. In the 2010-2011 academic year, other ourchases included a LiCor Odyssey near-infrared imaging system, a Promega 96-well plate dual-injector spectrophotometer and luminometer, a Millipore Q3 water purification system, and a BioRad real-time PCR optical system. The following equipment was purchased within the prior six years: six VIS/UV spectrophotometers, five inverted microscopes, a Nikon TE2000S epifluorescent inverted microscope system with NIS-Elements research imaging software, a Guava EasyCyte benchtop microcytometry system, Protean II vertical gel electrophoresis system and Transblot cell with power supply for use with gels and western blots, a Glomax 20/20 luminometer, a photodocumentation center, and two laminar flow hoods.

To enhance the **laboratory experiences** in the introductory Biology courses, both for Biology majors (Principles of Biology) and for non-majors (Human Biology), in the Summer, 2008 forty brightfield microscopes were purchased. In the Summer, 2009, Moticam microscope cameras, projectors, and screens were installed in the two laboratories in which the major and non-major introductory biology courses meet. The camera was interfaced with a computer, allowing the microscope image to be projected on the large screen in front of the room. Furthermore, the computer with projector and screen was a valuable addition for instructors who use PowerPoint presentations as part of their lectures. Three thermocyclers, for use in polymerase chain reactions and purchased in the Summer, 2010, are housed in the Sussman laboratory, a state-of-the-art laboratory utilized for the advanced biology courses. Financed through the Alexander Foundation, in Fall, 2016, a Coulter counter was purchased to enhance student laboratory experiences in the courses.
In this past summer, 2018, several microscopes were purchased for use in the teaching labs, computers to interface with an ELISA reader (Schuck lab) and a photodocumentation center (Vigodner lab), a nutator, and a shaking water bath (Vigodner lab).

In the 2017-2018 academic year, the **Biology Club** organized a series of career workshops for SCW students majoring in Biology. One particularly nice and informative workshop included a panel of SCW graduates from a variety of professions who spoke about their particular fields of interest. Another workshop focused on instructing the proper protocol for formulating a resume and writing a cover letter for summer internship applications. A rather "fun" seminar was "Meet and munch with SCW Biology faculty," in which the biology faculty discussed their research and courses. The Biology Club held its annual fundraiser to raise awareness about breast cancer and to benefit "Sharsheret."

Department of Chemistry and Biochemistry

Lora Danley, M.S.; Cecily Dobin, M.S.; Ran Drori, Ph.D; Donald Estes, Ph.D.; Jianfeng Jiang, Ph.D.; Stav Kemeny, Ph.D.; Chaya Rapp, Ph.D.; Rosalyn Strauss, Ph.D.

In keeping with the approach to science education at SCW, the Department of Chemistry and Biochemistry offers a series of high level courses, opportunities for undergraduate research, and extracurricular programming to foster an enthusiasm for science and an interest in scientific research.

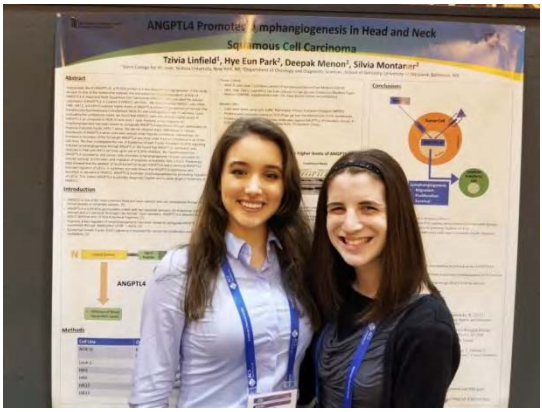
The Department of Chemistry and Biochemistry offers majors in both Chemistry and Biochemistry. Instituted as an official major several years ago, the Biochemistry major is popular among students interested in a broad science background, including those that are preparing to attend medical and dental school. In the fall of 2017, three Biochemistry and Chemistry graduates entered prestigious Ph.D. programs in the biomedical sciences, at the Tri-institutional Weil Cornell/Rockefeller/Sloan Kettering program, Sloan Kettering graduate program, and the Sue Golding graduate division of AECOM. Other Chemistry and Biochemistry graduates have gone on to medical, dental, optometry, and law schools, and careers in science education.

The courses in our department are continuously being updated to keep pace with current scientific discovery and new technology. In our Honors General Chemistry course, students read articles from current scientific literature related to course content. Courses in analytical chemistry and biochemistry incorporate experiments that are related to the instructors' research interests allowing content to be taught in the context of current, cutting edge, and biologically relevant research. State of the art instrumentation including a nuclear magnetic resonance spectrometer, an automatic titrator, a multimode plate reader, data acquisition software and probes, and molecular modeling software, have been integrated into laboratory courses on all levels so that our students are trained in the use of current laboratory technology. The department also offers a Science Fundamentals course which is popular among students pursuing education or business degrees, and a Chemistry for non-majors course which serves students entering the allied health fields. These courses focus on chemistry as it relates to the world around us and contemporary environmental issues.

In the fall of 2017, Dr. Ran Drori formerly of Hebrew University and NYU, joined the Department of Chemistry and Biochemistry. The Drori laboratory's main focus is the study of ice-binding proteins (or antifreeze proteins), which aid a variety of organisms to survive in subfreezing temperatures. A unique combination of sensitive temperature control and a fluidic system allows for the cutting-edge capability to study the interaction of molecules with microscopic ice crystals. This advanced instrumentation is coupled with a

collaboration with researchers from Canada, the Netherlands and the US, who supplied the purified antifreeze proteins. Several students have begun working in the Drori lab, including Tehilla Berger, who recevied the 2018 Kressel award to continue her project entitled *"The Mechanism by Which Antifreeze Glycoproteins Protect Antarctic Fish from Freezing"* through the 2018-2019 academic year.

The department supports extra-curricular activities that enhance student interest and appreciation of chemistry and science in general, both on campus and in the broader community. The Stern College Chemistry Club is a student affiliate of the American Chemistry society and is advised by Don Estes and Chaya Rapp. The club received a Commendable Chapter Award for its 2016-2017 activities from the American Chemical Society. The award was presented at the national ACS meeting in New Orleans in March 2018 and the club received a travel grant from the ACS to help defray some of the costs of students attending the conference. In addition, the club was awarded a Community Interactions Grant from the Undergraduate Programs Office of the ACS to conduct an outreach program at a local NYC elementary school.



Lior Levy and Tzivia Linfield, winners of the Stern College poster competition, present their posters at undergraduate poster session of the 2018 ACS meeting in New Orleans, LA.

Tzivia Linfield accepting the Commendable Chapter Award from the ACS in New Orleans, LA

Chemistry Club members at an outreach event at a local New York City public school.

Chemistry Club members at the annual magic show.

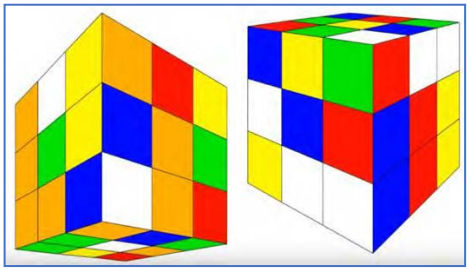
Department of Computer Science

Alan Broder, Clinical Professor (Chair); Joshua Waxman, Assistant Professor; Ari Shamash, Adjunct Instructor; Alexey Lopukhin, Adjunct Instructor

The Computer Science program at Stern College for Women stresses both the practical and theoretical aspects of computing, preparing students for employment in various fields of computer science and to pursue graduate studies. There is a strong emphasis in the department on preparation for challenging jobs in industry – our faculty and adjuncts come from positions of intensive industrial experience and leadership. In addition to covering fundamentals of Computer Science theory and practice, the department strives to help students maximize their portfolios of significant coding projects, via course requirements and through extracurricular activities such as hackathons and internships.

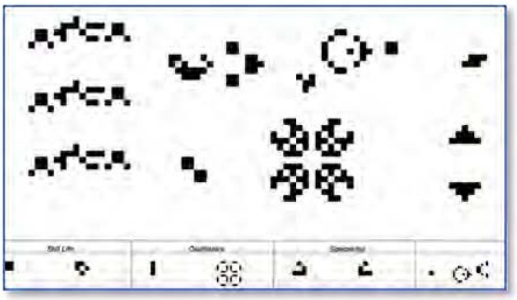
For highlights of a few notable semester capstone projects from our COMP 1300 – Introduction to Computer Science course see the video at http://demoreel.sterncs.net/

While these projects seem to be just games, the video demonstrates how much can be accomplished in just a first semester of CS. The semester projects are an inspirational stepping stone to further CS learning, and indeed many of our COMP 1300 students move on to more advanced learning and majoring in Computer Science.



Self-solving Rubik's Cube
Brielle Broder

Low Pop
Talia Bean



Conway's Game of Life
Sarah Gulkowitz

In the CS degree program, students gain experience with a variety of programming languages including Python, Java, Javascript, R, Go, and C/C++, while learning how to develop applications for Linux, web, and cloud platforms such as Hadoop and Spark.

Stern's Computer Science program is ideally situated near the heart of Manhattan's "Silicon Alley", convenient to recruiters from major financial and tech employers. Stern Computer Science students have recently been sought and hired for internships and post-graduation employment by premiere employers such as Microsoft, Palantir, Facebook, Goldman Sachs, JPMorgan, UBS, Nomura, and Google.

The department also offers the Professor Thomas Otway Memorial Scholarship for exceptional students who choose Computer Science as their major, established in memory of the beloved Professor.

Students in the department run a chapter of ACM-W, the international Association of Computing Machinery - Women's division. In 2018, Stern ACM-W members ran a hackathon called codeHer – the first city-wide hackathon run by and for orthodox women Computer Science students. Stern students also participate in running the city-wide Invent YU hackathon, and have also been participants in the nationwide jHacks hackathon held at the University of Maryland Hillel.

Invent YU Hackathon
Avital Greenberg, Elana Apfelbaum, Sarah Graff

The ACM-W chapter also offers frequent events throughout the year, such as guest lecturers by computer scientists from prominent companies, resume workshops, networking events, and coding practice sessions. Stern CS students are committed to helping other women develop as computer scientists, and frequently serve as peer tutors and teaching assistants in the department, they volunteer at local high schools, and are leaders of high school tech events.

High-achieving students in the S Daniel Abraham honors program will also benefit from an enriched CS educational experience. As part of the honors program, students complete an honors research program and thesis with the mentorship of a CS department faculty member.

Department of Mathematical Sciences

Faculty: Edward Belbruno, Ph.D.; Wenxiong Chen, Ph.D.; Michael Dalezman, Ph.D.; Marian Gidea, Ph.D. (Chair); Antonella Marini, Ph.D.; Morton Lowengrub, Ph.D.; Pablo Roldan, Ph.D.

Affiliate, Quantitative Finance: Yuri Katz, Ph.D.

Affiliates, Physics: Neer Asherie, Ph.D.; Sergey Buldyrev, Ph.D.; Gabriel Cwillich, Ph.D.; Mark Edelman, Ph.D.; Emil Prodan, Ph.D.; Lea Santos, Ph.D., Fredy Zypman, Ph.D.

Mathematics is crucial to the advancement of all other disciplines: biology, medicine, astronomy, robotics, communications, finance, security, technology, and computer science. Students majoring in mathematics enjoy a variety of job opportunities, such as actuaries, computer scientists, quantitative analysts, researchers, teachers and academics. Many other fields that require applied science and technology frequently hire people with a strong mathematical background. This versatility lends itself to a job seeker's market, and the result is a high average annual salary. Professions in mathematics top the best "jobs of tomorrow", in a ranking based on hiring outlook, stress, environment, and income.

The Stern College Department of Mathematical Sciences is leading the way in Yeshiva University's efforts prepare its students for the marketplace of tomorrow. Our mathematics courses provide students with key knowledge in theoretical and applied mathematics, and help them enhance their analytical abilities and heighten their creative potential. Students in the mathematics program have the opportunity to choose a concentration in Pre-Actuarial/Financial Mathematics. Advanced coursework is focused on modern mathematics, including differential equations, probability and statistics, mathematics of finance, time series, scientific computing, data analysis, network science, mathematical biology, and chaos theory. In addition to coursework, students may participate in research projects focuses on specific areas of practice, or industrial applications, under the guidance of highly active research faculty or industry mentors. There is variety of enrichment activities organized at Stern College, including the math club "No Limits", Mathematical Colloquia, and citywide seminars in Dynamical Systems and/or Mathematical Physics, which include speakers from around the world.

In addition to an undergraduate degree, the department offers an MA program, as well as a PhD program in Mathematics. An excellent option for math students is the BA/MA program, where qualified undergraduate students can take math graduate classes, and receive up to 12 credit hours of graduate courses towards the BA degree.

Our courses are taught by distinguished faculty with a tradition of excellence in teaching, mentoring, and research. Below are some highlights on our faculty research:

- Prof. Belbruno is the recipient of Humboldt Research Award in 2017, awarded by the Alexander von Humboldt Stiftung/foundation of Germany for lifetime achievements. He designed space missions for NASA and other space agencies, and he created new mathematical models in cosmology, such as for the Big Bang and for black holes.
- Prof. Chen has made significant advances in the theory of nonlinear elliptic partial differential equations and geometric analysis.
- Prof. Dalezman has done research in the theory of prime numbers.
- Prof. Gidea provided a solution to a long standing open problem is mathematics, the Arnold diffusion conjecture.
- Prof. Katz employs methods rooted in the physics of complex non-equilibrium systems to perform credit risk modeling.
- Prof. Lowengrub is one of the fathers of the WIYN Observatory (Arizona), and a former vice-president of the Association of Universities for Research in Astronomy (AURA). The asteroid 4045 Lowengrub is named after him.
- In the scientific literature, the standard boundary conditions for gauge-invariant equations are called “Marini conditions” in honor of Prof. Marini’s research in this area.
- Prof. Roldan developed a new mathematical theory to explain the existence of “Kirkwood gaps'' in the Main Asteroid belt.
- Several members of the faculty have written textbooks and monographs in their fields.
- Faculty research has been funded by National Science Foundations, National Aeronautics and Space Administration, National Institute of Health, National Cancer Institute, Simons Foundation, Sloan Foundation, Boeing Corporation, etc.
- Faculty members are frequently invited to lectures at major conferences and workshop in the US as well as other counties in America, Europe, Asia, and Africa.

Department of Physics

Emil Prodan, Ph.D., Professor
Lea Ferreira dos Santos, Ph.D., Professor
Mark Edelman, Ph.D., Clinical Associate Professor

The commitment of faculty to the "research and discovery approach" to education is a hallmark of Physics Department at Stern College for Women (SCW). Talented students will aspire to a degree in physics due to the opportunities that have been created in the department over the years. All faculties pursue an active research agenda, their articles being published in prestigious professional journals and their work has been highlighted in several occasions and awarded with major research grants. The exposure to such first class science and the atmosphere of discoveries plays a major role for undergraduate students shaping their career plans.

Stern College students who are interested in physics, physical sciences or engineering have an opportunity to actively participate in faculty research. The Physics Department is always seeking new students interested in doing first class research. They can choose from a variety of projects and work under the guidance of physics department members. Stern physics students undertake research during the summers and throughout the year. They present their results at national and international science meetings and give seminar talks. Physics, Physical Sciences and Pre-engineering students, mentored by Department faculty, are also coauthors in refereed articles published in physics, chemistry, and materials science journals.

Below are the highlights of our Physics Department:
External funding

01/01/2016-12/31/2018
Sponsor: National Science Foundation
Project Title: Physics of Interacting Quantum Systems with Phase Transitions" (DMR - 1603418)
Role: Principal Investigator
Amount: US$285,000

01/06/2016-01/06/2019
Sponsor: Keck Foundation
Project Title: Engineering New Materials Based on Topological Phonon Edge Modes
Role: Principal Investigator
Amount: US$ 1,000,000

01/07/2011-01/07/2017
Sponsor: National Science Foundation

Project Title: CAREER: Disorder and Interaction Effects in Topological Insulators (DMR 1056168)
Role: Principal Investigator
Amount: US$ 425,000

Postdocs supervised

Yafis Barlas (by Emil Prodan)
Mauro Schiulaz (by Lea F. Santos)
Jianfeng Wang (by Mark Edelman)

Students involved in research

Esther Vidal (summer 2018)
Aviva Shooman (spring and summer 2018)
Elisheva Muskat (2017-2018)
Shira Siegel (honor thesis, 2017-2018)
Tamar Felman (honor thesis, 2016-2017)
Jonathan Karp (Kressel + honor thesis, 2016-2017)

(a) Dr. Mark Edelman

Peer-reviewed articles

1. M. Edelman, "On Stability of Fixed Points and Chaos in Fractional Systems", Chaos, **28,** 023112 (2018).

Book edited

1. M. Edelman, E. Macau, and M. A. F. Sanjuan (eds.), *Chaotic, Fractional, and Complex Dynamics: New Insights and Perspectives*; *Series: Understanding Complex Systems*, Springer, eBook, 2018, http://www.springer.com/us/book/9783319681085

Book Chapters

1. M. Edelman, E. Macau, and M. A. F. Sanjuan, "New Insights and Perspectives in Chaotic,Fractional, and Complex Dynamics", in: M. Edelman, E. Macau, and M. A. F. Sanjuan (eds.): *Chaotic, Fractional, and Complex Dynamics: New Insights and Perspec-tives; Series: Understanding Complex Systems*, 1–7, Springer, eBook, 2018.
2. M. Edelman, "Universality in Systems with Power-Law Memory and Fractional Dynamics", in: M. Edelman, E. Macau, and M. A. F. Sanjuan (eds.): *Chaotic, Fractional, and Complex Dynamics: New Insights and Perspectives; Series: Understanding Complex Systems*, 147–171, Springer, eBook, 2018.
3. M. Edelman, "On nonlinear fractional maps: Nonlinear maps with power-law memory", *Chaos, Complexity and Transport Proceedings of the CCT '15, Conference on Chaos, Complexity and Transport 2015, Marseilles, France*, 1 – 5 June 2015; Xavier Leoncini, Christophe Eloy, and Gwenn Boedec (Editors), pp. 119-130, World Scientific, Singapore, 2017.

On-line:
http://www.worldscientific.com/doi/abs/10.1142/9789813202740_fmatter

4. M. Edelman, "Maps with power-law memory: direct introduction and Eulerian numbers, fractional maps, and fractional difference maps, in: A. Kochubei and Y. Luchko (eds.), *Handbook of Fractional Calculus with Applications, Volume 2, Theory,* De Gruyter, Berlin, 2018 (accepted).
5. M. Edelman, "Dynamics of nonlinear systems with power-law memory" in V.E. Tarasov (ed.), *Handbook of Fractional Calculus with Applications, Volume 2, Applications in Physics,* De Gruyter, Berlin, 2018 (accepted).

Invited talks

1. July 3-5, 2017; **International Conference on Nonlinear Dynamics and Complexity; (NDC 2017),** ŁÓDŹ, POLAND (http://www.ndc17.p.lodz.pl/), **Invited talk** "New face of universality in nonlinear fractional dynamics".

2. May 2017, **Invited lecture** "Nonlinear Fractional dynamics" at School of Control Science and Engineering and Power Electronic Energy-saving Technology & Equipment Engineering Research Center of Education Ministry, Shandong University, Jinan, China.

Editorial Boards

1. Fractional Calculus and Applied Analysis
2. Journal of Applied Nonlinear Dynamics.

(b) Prof. Emil Prodan

Peer-reviewed articles

8. D. J. Apigo, K. Qian, C. Prodan, E. Prodan, Topological Patterns, under review by Nature Physics (arXiv:1803.00984, 2018).
7. K. Qian, D. J. Apigo, C. Prodan, E. Prodan, Theory and Experimental Investigation of the Quantum Valley Hall Effect, under review by Phys. Rev. X (arXiv:1803.08781, 2018).
6. J. Kellendonk, E. Prodan, Bulk-Boundary Principle in Sturmian Kohmoto type models, under review by Annals of Henri Poincare (arXiv:1710.07681, 2017).
5. C. Bourne, E. Prodan, Non-Commutative Chern Numbers for Generic Aperiodic Discrete Systems, to appear J. Phys. A: Math. & Theor. (2018).
4. D. J. Apigo, A. Kanwa, J. Palmier, K. Dobiszewsky, R. C. Farro, G. A. Thomas, E. Prodan, C. Prodan, Water-Wave Crystals: An Experimental Platform, Scientific Reports 8, 3324 (2018).
3. T. Kuhne, E. Prodan, Disordered Crystals form First Principles I: Quantifying the Configuration Space, Annals of Physics 391, 120-149 (2018).
2. E. Prodan, Topological insulators at strong disorder, invited paper for the 2015 Congress on Mathematical Physics.

1. E. Prodan, K. Dobiszewski, A. Kanwal, J. Palmieri, Camelia Prodan, Dynamical Majorana edge modes in a broad class of topological mechanical systems, Nature Communications 8, 14587 (2017).

Book

E. Prodan, A Computational Non-Commutative Geometry Program for Disordered Topological Insulators, Springer Briefs in Mathematical Physics, Springer, 2017.
(http://www.springer.com/us/book/9783319550220).

Organized conference

Workshop: Topological Dynamics: Quantum and Classical
(NJIT, Newark, NJ, Nov/06-08, 2017)

Invited talks

17. 'Opportunities and Challenges with Topological Mechanical Systems,' lecture for the ARO workshop "Meta-structures: Dynamics, Topology and Related Opportunities," Georgia Tech, May 2018.
16. 'Topological Patterns,' lecture for the workshop "Topological Protection in Messy Matter," Georgia Tech (USA), May 2018.
15. 'Fun with Patterns,' lecture for the Mathematical Physics Seminar, Yeshiva University (USA), May 2018.
14. 'Dynamically Patterned Resonators,' colloquium for the Institute of Physics, Universidad Autónoma de San Luis Potosí (Mexico), April 2018.
13. 'Aperiodic Topological Systems,' lecture for the Mathematical Physics Seminar, LaGuardia College (USA), March 2018.
12. 'Charge Transport in Thermally Disordered Crystals,' lecture at a workshop at Inst. for Math. and its Applications (USA), March 2018.
11. 'Topological Edge Spectrum for Equivariant Hamiltonians over Dynamically Generated Patterns,' lecture for the Mathematical Physics Seminar, Purdue University (USA), Dec. 2017.
10. 'Topological Edge Spectra in Aperiodic Structures,' lecture for the workshop on "Topological Dynamics: Classical and Quantum," New Jersey Institute of Technology (USA), Nov 2017.
9. 'Topological Edge States in Physical Systems,' lecture for the workshop on "Spectral Structures and Topological Methods in Mathematical Quasicrystals," Oberwolfach International Mathematics Institute (Germany), Oct 2017.
8. 'The K-theoretic Bulk-Boundary Principle for Patterned Resonators,' lecture for the workshop on "Photonic Topological Insulators," BIRS International Station (Banff, Canada), Sept 2017.
7. 'Topological Edge States,' Physics Colloquium at New Jersey Inst. of Technology, May 2017.
6. 'Correlated topological phases: A KK-theoretic framework,' lecture for the workshop on "Strongly Correlated Topological Phases of Matter," Simons Center for Geometry and Physics, Stony Brook (USA), June 2017.

5. ‘Elements of a Computational Program in Non-Commutative Geometry,’ lecture for hot-topic workshop “Mathematical Modelling of 2D Materials” organized by Institute for Mathematics and its Applications, Minneapolis (USA), May 2017.
4. ‘Fun with K-Theory and Aperiodic Structures’, talk for the workshop ‘Mathematical and Physical Aspects of Topologically Protected States’, Columbia University, May 2017.
3. ‘Bulk-Boundary Correspondence for Aperiodic Systems: A K-Theoretic Approach,’ lecture for workshop “Novel Optical Materials” organized by Institute for Mathematics and its Applications, Minneapolis (USA), March 2017.
2. ‘A KK-Theoretic Framework for Topological Insulators’, talk for the workshop ‘KK-theory, Gauge Theory and Topological Phases’, Lorentz Center, Leiden (Netherlands), March 2017.
1. ‘Topological Networks of Coupled Resonators,’ talk for the conference ‘Topological Metamaterials,’ Aspen (USA), Jan 2017.

(c) Prof. Lea F. Santos

External funding
01/01/2016-12/31/2018
Sponsor: National Science Foundation
Project Title: Physics of Interacting Quantum Systems with Phase Transitions” (DMR - 1603418)
Amount: US$ 285,000

Peer-reviewed articles
13) E. J. Torres-Herrera and Lea F. Santos, Signatures of chaos and thermalization in the dynamics of many-body quantum systems, arXiv: 1804.06401 (Eur. J. Phys.)
12) Fausto Borgonovi, Felix M. Izrailev, and Lea F. Santos, Exponentially fast dynamics in the Fock space of chaotic many-body systems, arXiv: 1802.08265 (Phys. Rev. Lett.)
11) Mauro Schiulaz, Marco Távora, and Lea F. Santos, From few- to many-body quantum systems, arXiv: 1802.08691 (Quantum Sci. Technol.)
10) Rubem Mondaini, Krishnanand Mallayya, Lea F. Santos, and Marcos Rigol, Comment on ``Systematic Construction of Counterexamples to the Eigenstate Thermalization Hypothesis", arXiv: 1711.06279 (Phys. Rev. Lett.)
9) A. del Campo, J. Molina-Vilaplana, L. F. Santos, and J. Sonner, Decay of a Thermofield-Double State in Chaotic Quantum Systems: From Random Matrices to Spin Systems, arXiv: 1709.10105 (Eur. J. Phys.)
8) Sergio Lerma-Hernandez, Jorge Chavez-Carlos, Miguel A. Bastarrachea-Magnani, Lea F. Santos, and Jorge G. Hirsch, Survival probability of coherent states in regular regimes, arXiv: 1710.05937 (J. Phys. A)
7) E. J. Torres-Herrera, Antonio M. García-García, and Lea F. Santos, Generic dynamical features of quenched interacting quantum systems:

Survival probability, density imbalance, and out-of-time-ordered correlator, Physical Review B 97, 060303(R) (2018).
6) E. J. Torres-Herrera and Lea F. Santos, Dynamical manifestations of quantum chaos: correlation hole and bulge, Phil. Trans. R. Soc. A 375, 20160434 (2017).
5) E. J. Torres-Herrera and Lea F. Santos, Extended nonergodic states in disordered many-body quantum systems, Ann. Phys. (Berlin), 1600284 (2017).
4) Jaime L. C. da C. Filho, Andreia Saguia, Lea F. Santos, and Marcelo S. Sarandy, Many-body localization transition through pairwise correlations, Physical Review B 96, 014204 (2017).
3) Marco Tavora, E. J. Torres-Herrera, and Lea F. Santos, Power-law decay exponents: A dynamical criterion for predicting thermalization, Physical Review A 95, 013604 (2017).
2) Milan Sindelka, Lea F. Santos, and Nimrod Moiseyev, Excited-state quantum phase transitions studied from a non-Hermitian perspective, Physical Review A 95, 010103(R) (2017).
1) Francisco Perez-Bernal and Lea F. Santos, Effects of excited state quantum phase transitions on system dynamics, Fortschr. Phys. 65, 1600035 (2017).

Proceeding article
1) Lea F. Santos, and E. Jonathan Torres-Herrera, Analytical expressions for the evolution of many-body quantum systems quenched far from equilibrium, AIP Conference Proceedings 1912, 020015 (2017).

Book Chapters
2) Lea F. Santos and E. Jonathan Torres-Herrera, Nonequilibrium many-body quantum dynamics: from full random matrices to real systems, in *Quantum Thermodynamics*, arXiv: 1803.06012
1) Lea F. Santos and E. Jonathan Torres-Herrera, Nonequilibrium quantum dynamics of many-body systems, in *Chaotic, Fractional, and Complex Dynamics: New Insights and Perspectives*; *Series: Understanding Complex Systems*, (Springer, 2018), arXiv: 1706.02031

Organized conference
1) International Workshop Disordered Systems: From Localization to Thermalization and Topology, South Korea (September/3-7, 2018)

Invited talks
19) Workshop on Ergodicity breaking in many body systems, Natal, Brazil (October, 2018)
18) Workshop on Out of equilibrium dynamics of many-body systems, Osnabrück, Germany (September/24-26, 2018)
17) International Workshop Disordered Systems: From Localization to Thermalization and Topology, South Korea (September/3-7, 2018)
16) Chirikov Conference, Cuernavaca, Mexico (June, 2018)
15) 9th international workshop: Quantum Phase Transitions in Nuclei and Many-body Systems, Padova, Italy, (May, 2018)

14) Xi'an Jiaotong University, China (May, 2018)
13) Max Planck Institute, Dresden, Germany (March, 2018)
12) Workshop on Quantum Many-Body Systems Far From Equilibrium
(Stellenbosch, South Africa, Mar/12-16, 2018)
11) Workshop: Progress in quantum collective phenomena - from MBL to black holes
(Simons Center, Stony Brook, NY, Nov/13-17, 2017)
10) Workshop "Quantum Thermodynamics"
(ITAMP, Harvard University, Cambridge, MA, Oct/30-Nov/01, 2017)
9) Workshop: Topological Dynamics: Quantum and Classical
(NJIT, Newark, NJ, Nov/06-08, 2017)
8) Workshop: Wonders of Broken Integrability
(Simons Center, Stony Brook, NY, Oct/02-06, 2017)
7) Quantum Innovators
(Waterloo, Canada, Oct/2-5, 2017)
6) 2nd Brazilian Meeting on Statistical Mechanics
(Ilhéus, Bahia, Brazil, Sep/17-20, 2017)
5) Open Quantum Systems
(Bengaluru, India, Jul/17-28, 2017)
4) FQMT 2017: Frontiers of Quantum and Mesoscopic Thermodynamics
(Prague, Czech Republic, Jul 09-15, 2017)
3) NMP17: Nuclei and Mesoscopic Physics 2017 Conference
(East Lansing MI, USA, Mar 06-10, 2017)
2) The Royal Society
(London, UK, Feb/6-7, 2017)
1) Universidad Autónoma de Mexico
(Mexico City, Mexico, Jan/23, 2017)

Postdoc Dr. Schiulaz's presentations:
2) APS March Meeting, Los Angeles, USA (March, 2018)
1) Boston University, Boston, USA (March, 2018)

Department of Psychology

Joshua Bacon, Ph.D.; Lisa Chalik, Ph.D.; Terry DiLorenzo, Ph.D. (Chair); Rachel Ebner, Ph.D.; Rebecca Greif, PhD.; Marcel Perlman, Ph.D.

As a discipline, Psychology is generally categorized as a Social Science together with other fields such as Social Work, Political Science, Economics, and Sociology. However, scientific methodology and empirical research have always been a critical component of the coursework and extra-curricular opportunities offered by our department. Experimental Psychology, as a prerequisite for the majority of other courses offered, highlights the fundamental importance that we place on understanding the subject matter of psychology in the context of rigorous empirical analysis, research methodology, and scientific thinking. The Research Seminar, a course taken by psychology majors who are interested in pursuing a doctorate in Psychology, provides students with research opportunities and classroom instruction that advance their understanding of the application of research methodology to a "real world" setting. Some courses such as Cognition, Learning, and Psychobiology are rooted in the tradition of research and easily fit into the Science framework. Many other courses such as Social Psychology, Developmental Psychology, Psychology and Religion, Personality, and Abnormal Psychology are brought into the arena of Science by faculty who are grounded in scientific methodology and all have active research programs.

In addition to the general psychology major, the department also offers a specialty track in Behavioral Neuroscience This Behavioral Neuroscience track option for Psychology majors provides a focused education to students who are interested in the biology behind human and animal behavior. In addition to the core courses that are required of all majors, further requirements and electives come from critical courses in Neuroscience, such as Cognitive Neuroscience, Behavioral Neuroendocrinology, and a Neurobiology lecture and lab.

Students who are planning to apply to Ph.D. or Psy.D. programs in Psychology or to pursue careers in the other health-related fields such as Physical, Occupational, or Speech Therapy, are encouraged to become actively engaged in research. Students have gained invaluable experience outside the classroom by learning about the fundamental role of research in the theory and practice of psychology by working with faculty members in projects off-campus such as with Dr Joshua Bacon in the M.S. Care Center at NYU or with Dr. Aharon Fried on his research in Special Education in the Hebrew Schools. On campus, students have worked on research projects with Dr. Terry DiLorenzo focusing on health-related attitudes and cognitions and their relations to health behaviors. Many of the students who conducted research with our faculty have coauthored presentations at both national and international conferences.

For students whose interests lie in areas outside of those of the department, opportunities are available in a number of academic, hospital, and clinical settings. In this case, a faculty member may serve as a supervisor to maintain continuity of the student's experience as an integrated part of her program in psychology. Students engaged in research are encouraged to present their work at university-sponsored events and other professional meetings.

Below, we introduce the members of the Psychology Department and we look forward to the continued contributions of the Behavioral Sciences to Women in Science.

Dr. Joshua Bacon received his Ph.D. from NYU in 1976. During this time, he also conducted research at Swarthmore College with Dr. Hans Wallach, one of the last remaining students of Wolfgang Kohler, the founder of Gestalt Psychology. In 1976, Dr. Bacon obtained a position as Assistant Professor at Tufts University in Boston and received tenure in 1984. At that time, he was recruited by Yeshiva University and joined the Department of Psychology in 1984. He teaches basic courses in Experimental Psychology and Cognition, as well as the Cognitive Neuroscience course that is a basic requirement for the Behavioral Neuroscience track. Dr. Bacon's area of research is perception and cognition and, in particular, cognitive impairment and rehabilitation in patients with Multiple Sclerosis. He holds a position of Research Associate Professor in the Department of Neurology at the NYU Medical School and is a member of the clinical and research team in the Multiple Sclerosis Care Center of NYUHJD. He is currently working on a cognitive rehabilitation program for MS patients with cognitive impairments and is also the principle investigator of a project to develop a diagnostic battery that will measure subtle cognitive impairments that may emerge in the early stages of MS. Some of his recent studies have looked at the correlation between performance on one of the behavioral tests of cross hemisphere processing he developed and atrophy of the corpus callosum as seen on MRI scans. Undergraduate students from Stern College have been and continue to be involved in this research and have been coauthors on a number of poster presentations at conferences of the Academy of Neurology and of the Multiple Sclerosis Consortium.

Dr. Lisa Chalik received her Ph.D. in Psychology in 2016 from New York University, where she conducted research in the Conceptual Development and Social Cognition Lab and completed a concentration in Developmental Science. She then completed a postdoctoral fellowship at Yale University, where she worked in the Social Cognitive Development Lab and the Infant Cognition Center. In the Fall of 2018, she started as an Assistant Professor at Stern College for Women, where she teaches courses in Psychology and Development. She also founded and directs the Developing Minds Lab, the first ever psychology research lab on the SCW campus, where she mentors students who wish to receive first-hand experience conducting research in Developmental Psychology. Dr. Chalik's research area is social cognitive development; she focuses on the abstract theories that children build and rely upon as they navigate the social world. Specifically, she investigates how children learn to organize the people around them into social categories, and

how they make inferences about people on the basis of social category membership. She also studies the implications of social categorization for moral evaluation. She has published her findings in a number of top Psychology journals and regularly presents at professional conferences, such as the Society for Research in Child Development and the Cognitive Development Society.

Dr. Terry DiLorenzo received a B.A. in psychology from Rutgers University and a Ph.D. in Health Psychology from Ferkauf Graduate School of Psychology of Yeshiva University. She completed a postdoctoral fellowship at Memorial Sloan-Kettering Cancer Center and then was the Director of Research of the Multiple Sclerosis Comprehensive Care Center of New York Medical College until she joined the Psychology Department of Stern College for Women in 1999. Since joining the Department, Dr. DiLorenzo has conducted several studies examining health-related attitudes and cognitions and their relations to health behaviors. Dr. DiLorenzo has also conducted research on the psychometric properties of scales to assess mood and attitudes toward seeking health care. Dr. DiLorenzo also has an interest in sexual health behaviors and has completed a study on sexual health practices in Orthodox Jewish women. Dr. DiLorenzo has published her findings in articles in peer-reviewed journals and has presented at many professional meetings. In addition to her own research, Dr. DiLorenzo has mentored several honors students whose projects have been presented at professional meetings as well. Dr. DiLorenzo teaches several advanced courses including Human Sexuality, the Honor's Psychology Research Seminar, and Introduction to Public Health, in addition to Abnormal and Social Psychology. Dr. DiLorenzo also coordinates the recently developed Public Health Minor at Stern College.

Dr. Rachel Ebner received a Ph.D. in Educational Psychology from the CUNY Graduate Center, where she concentrated in Learning, Development, and Instruction. She also earned an Ed.M. in Prevention Science and Practice from the Harvard Graduate School of Education and an M.A. in Developmental Psychology from Columbia University's Teachers College. Her postdoctoral research has focused on devising and implementing methods to help students self-regulate their learning, especially when learning online. She has taught a variety of courses on child & adolescent development and educational psychology. In addition to teaching at Stern, she also serves as Yeshiva University's Director of Student Learning Assessment. She works with faculty and administrators on developing and supporting their programmatic learning assessment activities.

Dr. Rebecca Greif received a B.A. in psychology from Duke University and a Psy.D. in clinical psychology from the Rutgers Graduate School of Applied and Professional Psychology. She completed a postdoctoral fellowship at the Mount Sinai Eating and Weight Disorders Program, where she is an assistant professor. Dr. Greif's clinical expertise centers on the use of evidence-based treatments, in particular cognitive behavior therapy and dialectical behavior therapy, for adults with mood disorders, anxiety disorders, and eating disorders. She currently maintains a private practice for adults in

Manhattan. Dr. Greif's research interests focus on the advancement and dissemination of empirically supported treatments. Dr. Greif was previously a co-investigator on two NIH clinical research trials which examined the use of a smartphone application to augment treatment for individuals with binge eating disorder and bulimia nervosa. She is currently a co-investigator on an NIH clinical trial which tests a neurobiological model of food avoidance in anorexia nervosa and examines the efficacy of a novel treatment targeting disgust among adolescents with this type of eating disorder. In 2009 Dr. Greif received the Academy for Eating Disorders Early Career Investigator Award and in 2012 she was awarded an Aaron T. Beck Scholarship for Cognitive Therapy. Dr. Greif will begin her position as an assistant professor at Stern College the Fall of 2018. She will be teaching several courses in the undergraduate psychology department including introduction to psychology, abnormal psychology, and introduction to clinical psychology.

Dr. Marcel Perlman earned his B.A., M.A., and Ph.D. from Yeshiva University. He received his Doctorate in 1959. In 1958 he was appointed as an Instructor in Psychology at SCW, and in 1959 he was promoted to the rank of Assistant Professor. He became an Associate Professor in 1966 and attained his Professorship in 1979. Dr. Perlman became Chairman of the Division of Social and Behavioral Sciences in 2003. He has been a Clinical Supervisor at Ferkauf School of Psychology since 1982. As part of his Forensic Experience he has lectured for the Practicing Law Institute in the Area of Clinical Psychology and the Law. He is currently in limited Private Practice in Clinical and Forensic Psychology. Additionally, he has given numerous lectures and presentations, the latest of which was at the Oxford University (St. Anne's College) Annual Round Table on the topic of the Changing Paradigms of Contemporary Parenting.

Department of Speech Pathology/ Audiology

Prof. Joseph Danto, PhD (Chair); Neva Goldstein Hellman, MS; Susan Wilson, MS; Sydney Horn-Klein, MS; Allison Kaufman, AuD; Ashley Small, MS

The mission of the Department of Speech Pathology/Audiology is to prepare students for admission to advanced graduate programs in the fields of Speech Language Pathology and Audiology. Emphasis is placed upon the student acquiring knowledge of the underlying anatomy, physiology, physics, and philosophies of the mechanisms of speech, hearing, and language and of their development, impairment, and amelioration. As well, the mission includes preparing students to be successful, contributing members of society and the professions.

The students in the Department begin their investigation into speech, hearing, and language at the end of their sophomore year. The course sequence is relatively fixed and is designed to build the more advanced courses upon foundations established in the introductory classes. An active on-campus Speech and Hearing Club coalesces the student body and guides the newer students through an array of extracurricular options. Such extracurricular exposures enhance student appreciation of the practical and clinical applications of their academic preparation, and as well opening the door to questioning and investigating, as a prelude to research.

Students in the program have developed two initiatives to enhance and enrich their involvement in speech language pathology and audiology. The first initiative is the Speech and Hearing Journal, authored, edited, and published by students. The topics vary and have included language, speech and hearing issues related to autism and mutism, the effects of high sound levels on hearing, room acoustic resonance on speech, bilingual effects on non-fluent speech…among others.

The second initiative is a newsletter, providing the students with a less-formal format to share clinical and professional experiences with their peers, to update academic, administrative, and student-related issues, and, of course, to communicate social factors, as well. Students form a close association and relationship during their residence in the program. As the course sequence is "lock-stepped," students are class colleagues for over two years, with an association enhanced by several projects that encourage team working.

The Speech and Hearing Club provides another opportunity to expand their experience in speech pathology and audiology. Renowned speakers from outside the university, including former students, address the student body on clinical, administrative, and other professional topics. A highlight of the academic year is a series on "Grad School Nights," in which representatives from several graduate programs - either faculty or graduate students - address

our students as to the requirements, the advantages of each program, and the application processes.

Several of our students have been awarded Ben Gurion University summer fellowships. Last summer 2 women came back with glowing reports in both directions. The projects were in the bilingualism lab and the investigators were so please with our students, they accepted three women for this coming semester.

In addition to involvements with Speech Pathology/Audiology services at local institutions, our students have had opportunities to observe surgery of the spine and of the brain, as they shadowed audiologists involved in this subspecialty.

The entry level degree for Speech Pathology is a Masters and for Audiology it is a Doctorate. Traditionally, our students are accepted into graduate school at an impressive high percentage of those applying. Most have continued to clinical positions, others have become academicians and some have returned to Stern College as adjunct faculty. Students graduating in May, 2018, continued to be accepted in graduate programs in speech pathology/audiology at YU Graduate SLP, Touro College, Lehman College, Brooklyn College, CUNY – Aud, Montclair AUD, LI Consortium AUD, Northwestern University and others.

Stern College for Women Combined Programs

The following are the basic elements of combined degree programs in the sciences available to Stern College students in cooperation with other universities. Students interested in these programs generally apply to the cooperating institution during their junior year and are given a special shaped major so that they can complete all of the necessary prerequisites within the required time frame. The indicated years of study at Stern College includes the year of study abroad in Israel for those pursuing that option after high school. These programs are competitive and final admissions decisions are made by the cooperating institutions.

Engineering - B.A. /B.E. /B.S. or B.A. /M.S.

Yeshiva University offers combined plans in engineering with Columbia University School of Engineering and Applied Science (CU) as well as with the State University of New York at Stony Brook College of Engineering and Applied Sciences (SBU)

Under the BA/BS plan with Columbia, a student who maintains a 3.3 average overall as well as in Program-required courses (with no grade lower than a B in courses required by Columbia), and receives the recommendation of the pre-engineering adviser is admitted to Columbia University School of Engineering and Applied Science. Upon successful completion of the two-year program at Columbia, YU confers the Bachelor of Arts degree and Columbia confers the Bachelor of Science degree.

Under the combined plan with Stony Brook University, a student can earn both a B.A. degree from YU and a B.E. degree in engineering (or, in some cases, an M.E.) from Stony Brook University. Students in combined plans must maintain registration at Yeshiva University by filing a Leave of Absence Form until they receive the B.A. degree. They must meet all specific graduation requirements (other than completing the 128 credits required for graduation) before continuing in the school of engineering.

Nursing - B.A./B.S.N./M.S.N.

Stern College offers a combined program in nursing with New York University's College of Nursing (NYUCN). In this program, students complete 7 semesters of required course work with a minimum of 119 credits at Stern College (5 semesters and 84 credits in residence at Stern College for those students studying in Israel for a year). Eligible students may then be admitted to a 15-month accelerated program at NYUCN which begins in January of their senior year. Students receive a B.A. degree from Stern College for Women after successfully completing one semester at NYUCN. They are awarded the BSN from NYU at the successful completion of the nursing program and officially become a registered nurse (RN) upon passing the licensing exam. Students who maintain a 3.0 GPA while at the NYUCN

are guaranteed a spot in their MSN program to become a nurse practitioner, which they may apply to after a short period of working as a RN.

Occupational Therapy - B.A./M.S.

Stern College offers a combined program in Occupational Therapy with Columbia University (CU). During the first 3 years at SCW, students complete college requirements and prerequisites for CU's OT program. They apply to the 2-year CU program during the fall semester of their junior year. Students are awarded the B.A. from Stern College after their first year at CU, and the M.S. upon completion of the program.

Optometry - B.A./O.D.

Stern College and the State University of New York (SUNY) College of Optometry offer an affiliation program to qualified students through which they can receive an undergraduate degree and a Doctor of Optometry degree in seven years. Students accepted into this program attend SCW for three years while they complete college requirements and prerequisites for the College of Optometry. After the first year at SUNY College of Optometry, students receive the B.A. degree. The O.D. degree is awarded after completing the four years at SUNY College of Optometry

Physical Therapy - B.A./DPT

Stern College offers combined program in Physical Therapy with Rutgers, the State University of New Jersey. During their first three years at Stern College (two years for those studying in Israel for a year), students complete college requirements and the prerequisites for entry into Rutgers' Doctorate of Physical Therapy Program. Students are awarded a B.A. from Stern College after completing their first year at Rutgers and the DPT upon successful completion of the 3-year doctoral program.

In addition, though an Articulation Agreement with the New York Medical College Graduate School of Health Sciences (NYMC), students may apply to NYMC's Early Acceptance Program. Qualified students receive provisional acceptance to the 3-year DPT Program after their junior year, while final acceptance is granted upon satisfactory completion of their senior year at SCW.

Physician Assistant - B.A./M.S.

Stern College offers a combined program in Physician Assistant Studies with Mercy College. During their first three years at Stern (two years for those studying in Israel for a year), students complete college requirements and the prerequisites for Mercy College's M.S. program. After completing 111 credits with a minimum overall GPA of 3.0, a minimum 3.2 GPA in the designated science courses and with at least a "B" in prerequisite courses, accepted applicants to the program continue at Mercy College during what would have

been their senior year at Stern. After the first year at Mercy College, students receive a B.A. degree from Stern College. The M.S. degree is awarded after successfully completing two years and three months at Mercy and the student becomes a PA after passing her licensing exam.

Podiatry - B.A./D.P.M.

Stern College and the New York College of Podiatric Medicine offer a combined program in Podiatry. During the first three years, students recommended to the program complete college requirements and prerequisites for the NY College of Podiatric Medicine. After the first year at NYCPM, SCW awards the B.A. NYCPM awards the D.P.M. at the completion of the program.

Teaching, Math and Science - B.A./M.A.

Through an articulation agreement with the NYU Steinhardt School of Culture, Education, and Human Development, Yeshiva University juniors and seniors may enroll in selected math or science education courses at NYU. These courses will count both toward the undergraduate degree at SCW and will reduce the number of credits needed for a M.S. degree in math education or in science education from NYU Steinhardt. Students pay NYU directly for these credits.

Nutrition

Through an articulation agreement, SCW students may take selected courses in nutrition at NYU during their senior year at SCW and thus accelerate the time required to complete a subsequent degree in nutrition at NYU.

The Anne Scheiber Fellowship Program

The Anne Scheiber Fellowship Program provides scholarship support to Stern College undergraduates, as well as graduates, pursing their advanced training at the Albert Einstein College of Medicine. The program, established by Ms. Scheiber through a twenty two million dollar bequest, seeks to support high achieving women with financial need to realize their academic and professional goals. Stern College graduates who attend the University's Albert Einstein College of Medicine may apply for awards up to full tuition for their four years of medical training. We proudly salute the Anne Scheiber Fellows who are fulfilling Ms. Scheiber's dream:

Chaya Abelow
Agnes Nathalie Abitol
Nechama Ackerman
Grace Aharon
Diane Algava
Ariella Applebaum
Kayla Applebaum
Abigail Atlas
Miriam Ausubel
Rachel Aviv
Deena Avner
Tamar Belsh
Nomi Ben-Zvi
Abigail Bergman
Deena Blanchard
Rachel Blinick
Yael Boyarsky
Zahava (Nilly) Brodt
Faigy Burekhovich
Aviva Cantor
Tzipa Chaim
Aliza Charlop
Esti Charlop
Emily Chase
Elana Clark
Barrie Cohen
Davida Cohen
Michelle Cohen
Sarit Cohen
Jennifer Deluty
Ellen Dinerman
Nechama Drefus
Danielle Dubin
Batya Edelman
Esti Feder
Abigail Feldman
Tova Fischer
Rose Fluss
Aliza Forman
Rena Frankel
Tamara Freiden
Ahuva Freilich
Caryn Gamss
Eden Gelman
Julie Gilbert
Avigayil Ginsberg
Aviva Ginsburg
Ariella Glueck
Elizabeth Goldberger
Tova Goldstein
Dina Golfeiz
Sharon Gordon
Reena Gottesman
Jessica Gross
Rebecca Gross
Michelle Haimowitz
Orli Haken
Rebecca Herskovitz
Batya Hertzberg
Ariella Hollander
Wendy Hosinking
Tsipora Huisman
Julia Josowitz
Chava Kahn
Elisa Karp
Chava Kaufman
Shira Kaye
Rachel Kirshenbaum
Miriam Klahr
Hadassah Klerman
Michelle Kohansieh
Lea Kozirovsky
Aimee Krausz
Malka Krupka
Yosefa Lerner
Rikah Lerer
Elisheva Levine
Elana Levy
Emily Liebling
Elizabeth Lobell
Shira Marder
Yael (Jessica) Mayer
Alexandra Michalowski
Rachel Mirsky
Esther Mizrachi
Sara Mizrachi
Rachel Ahuva Motechin
Ahava Muskat
Ariella Nadler
Sarah Nattel
Helen Nissim
Saran Noble
Chana Gila Ovitz
Chaya Pinson
Yardanna Platt
Tehilla Raviv
Yael Raymon
Shuli Roditi-Kulak
Shira Roszler
Amanda Rubin
Miriam Rubin-Norowitz
Rachel Rubinstein
Chava Ruderman
Debbie Rybak
Michal Schechter
Esther Leah Schoenbrum
Chana Schonbrun
Naomi Schneider
Naomi Schwartz
Yosefa Schoor
Samantha Selesny
Galila Shapiro
Eliana Shaul
Nechama Mina Shoshani
Malki Silverman
Michelle Simpser
Rose Snyder
Shani Snyder
Tirtza Spiegel
Yael Steinberg
Miriam Steinberger
Tehilla Stepansky
Chana Stern
Miriam Stock
Temima Strauss
Jessica Tugetman
Tamar Riegel Weinberger
Yehudit Weinberger
Amanda Weiss
Meredith Weiss
Rebecca Weiss
Sara Leora Wiener
Bella Wolf
Sahar Zaghi

Student Accomplishments

Academic Year 2017-2018 and Summer, 2018
Department of Biology, Department of Chemistry and Biochemistry, Department of Computer Science, Department of Mathematical Sciences, Department of Physics, Department of Psychology, and Speech Pathology/Audiology (as of June 20, 2018)

Allopathic medicine (M.D.) - 28 students
Albert Einstein College of Medicine (13 students); additional 15 students in various American (including, Cooper Medical School of Rowan Univ.; New York Med. Coll.; Seton Hall Univ.; FIU Wertheim College of Med.; Stony Brook Med. Sch.; Med. Coll. of Wisconsin; Rutgers Robert Wood Johnson) and Israeli (Technion) medical schools

Osteopathic medical school (D.O.) - 7 students
NYITCOM (formerly, NYCOM): Touro College of Osteopathic Medicine

Dental school (D.D.S.) - 10 students
NYU; Univ. Pennsylvania; Touro; Tufts

Veterinary medicine (D.V.M.) - 1 student
University of Florida Veterinary School

Biomedical sciences (Ph.D.) - 1 student
Cedars-Sinai Medical Center

Clinical psychology (Ph.D.) - 3 students
Adelphi University; Fairleigh Dickinson; Queens College

Clinical psychology (Psy.D.) - 2 students
Rutgers University; Hofstra

Physical therapy (doctorate) - 3 students
Univ. of Southern California; LIU; Hunter

Audiology (doctorate) - 1 student
Montclair

Holistic/Oriental Medicine (M.S.) - 1 student
Pacific College of Oriental Medicine

Genetic counseling (M.S.) - 1 student
LIU - C.W. Post

Social work (M.S.W.) - 2 students
Wurzweiller

Biological sciences (M.S.) - 1 student
Fordham University

Biotechnology (M.S.) - 2 students
Katz School, Yeshiva University

Computer science (M.S.) - 1 student
NYU

Speech language pathology (M.S.) - 12 students
Lehman College; Touro

Marriage and family therapy (M.A.) - 1 student
Pepperdine

Law school (J.D.) - 2 students
Cardozo School of Law; University of Nevada - Las Vegas

Physician assistant - 9 students
SUNY Downstate; York College (CUNY); Touro; SUNY Downstate; LIU-Brooklyn; Mercy College

Occupational therapy (M.S.) - 4 students
Columbia Univ.; LIU-Brooklyn; NYU

Speech language pathology (M.S.) - 12 students
Lehman College; Touro; Montclair

Public Health (M.P.H.) - 2 students
Boston University; University of Pennsylvania (combined MSW/MPH program)

Bioethics (M.S.) - 1 student
Harvard Medical School

Nursing - 22 students
NYU (joint program - 14 students); NYU (accelerated program - 7 students); Columbia Univ. (accelerated program - 1 student)

Summer 2018 internships

Rachel Adama: Yeshiva College (Goswami lab)
Shana Adler: Mt. Sinai School of Medicine (Chrystian Junqueira-Alves)
Elana Apfelbaum: AECOM (SERC Scholar)
Audrey Amar: Harlem Hospital (Dr. Sabbagh)
Kayla Boldt: UBS Bank
Brielle Broder: Google

Ariella Ciment: Tifany & Co.

Adina Cohen: Goldman Sachs

Dahlia Cohen: NYU-Rusk Health Career Opportunity Program (Nursing)

Elisheva Cohen: NYU Medical Center (Dr. Tomas Kirchhoff)

Nechama Dembitzer: SCW Chemistry Department (Drori Lab)

Elen-Sarah Dolgopolskaia: YU- Bar Ilan Summer Research Program

Yael Eisenberg: YU- Bar Ilan Summer Research Program

Abigail Epstein: NYU School of Medicine, Dept. of Surgery & Cell Biology (Miller lab)

Nureet Esral: YU- Bar Ilan Summer Research Program

Jacqueline Fried: NYU-Rusk Health Career Opportunity Program (Nursing)

Bailey Frohlich: Dept. Molecular Pharmacology, AECOM (Aschner Lab)

Avital Greenberg: YU- Bar Ilan Summer Research Program

Abigail Goldberger: Peters VA Medical Center Spinal Cord Damage Research Center (Bronx)

Avital Greenberg: YU- Bar Ilan Summer Research Program

Sarah Graff: AECOM (Bergman Lab- Evolutionary Systems Biology)

Sarah Gulkowitz: Brookville Advisory

Aline Budet Halpern: research internship in Albert Einstein Hospital in Sao Paulo, Brazil

Jordana Hanover**:** NYU-Rusk Health Career Opportunity Program (Physical Therapy)

Bracha Jachter: NYU-Rusk Health Career Opportunity Program (Nursing)

Lauren Joseph: NYU-Rusk Health Career Opportunity Program (Nurse Practitioner)

Shani Kahan: Columbia University Medical Center Dept. of Anesthesiology

Tova Lambert: Feinstein Institute for Medical Research at Northwell Health (Deutschman Lab)

Devorah Lamm: YU- Bar Ilan Summer Research Program

Miriam Lattin: National Institutes of Health – National Cancer Institute

Alexandra Last: Gottlieb lab, Barbara Davis Center for Diabetes, U. of Colorado Medical School

Moreet Levine: YU- Bar Ilan Summer Research Program

Marjorie Liebling: Memorial Sloan Kettering Cancer Center: Computational Biology Summer Program (Fuchs Lab)

Tzivia Linfield: YU- Bar Ilan Summer Research Program

Courtney Marks: Sunnybrook Research Institute (Toronto, Canada) – studying aortic surgeries

Daniella Miller: The Rockefeller University (McEwen lab)

Racheli Moskowitz: Facebook

Elisheva Muskat: YU- Bar Ilan Summer Research Program

Ilana Radinsky: Palantir

Atara Safrin: NYU-Rusk Health Career Opportunity Program (Occupational Therapy)

Talia Schiff: YU- Bar Ilan Summer Research Program

Allison Schachter – YU- Bar Ilan Summer Research Program

Anna Schuman: YU- Bar Ilan Summer Research Program

Yardena Schwarcz: NYU-Rusk Health Career Opportunity Program (Nursing)

Michal Shamayeva: NYU-Rusk Health Career Opportunity Program (Nurse Practitioner)

Elianna Shavrit: AECOM (SERC Scholar)

Neda Shokrian: AECOM Summer Undergraduate Research Program

Aviva Shooman: SCW Physics Department (Santos Lab)

Liel Silverstone: Makor, Brooklyn (shadowing social workers & therapists)

Arina Sokolova: NYU Langone Medical Center (Dr. Berger's Lab)

Rachel Somorov: Baylor University (Genetics Department - Metabolemics Lab)

Esther Stern: Yeshiva U. – Psychology Research with Drs. Gallantucci & Malka (Wilf Campus)

Rebecca Stock: Rice University (Houston), Psychology Research

Gaalia Strupinsky - Department of Microbiology; Icahn School of Medicine; Mt. Sinai Hospital

Paulette Tawil: Nomura Bank

Ayliana Teitelbaum: Microsoft Data Science Summer School

Alexandra Tolmasov: Columbia University, Dept. of Ophthalmology (Petrukhin lab)

Sara Verschleisser: National Institutes of Health

Esther Vidal: Mount Sinai Medical Center (Department of Neurosurgery)

Tzipora Weinberger: YU- Bar Ilan Summer Research Program

Rachel Zakharov: Columbia University, Dept. of Ophthalmology (Petrukhin lab)

Isabel Zats: Ohio State University Wexner Medical Center (Dr. Zweier – Physiology)

Student Publications and Presentations

Scientific Journals
(Undergraduate names are in **bold** type)

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Presentations at Scientific Conferences

Koppel, A., Ranasinghe, O., Navarathna, M., Coors, C., Abeyweera, N., Codipilly, C., and Schanler. R., 2018, Acidic human milk fortification does not

enhance probiotic growth in human milk. Poster presentation, Pediatric Academic Societies Meeting, Toronto, Canada, May.

Codipilly, C., **Koppel, A.,** Navarathna, M., Ranasinghe, O., Coors, C., Abeyweera, N., and Schanler, R., 2018, Milk fat globule epidermal growth factor 8 (MFG-E8) in preterm human milk, Poster presentation, Pediatric Academic Societies Meeting, Toronto, Canada, May.

Codipilly, C., Navarathna, M., **Koppel, A**., Brewer, M., Maffei, D., Ranasinghe, O. and Schanler, R., 2018, Detection of milk fat globule epidermal growth factor 8 (MFG-E8)in intestinal secretions of preterm infants, Poster presentation, Pediatric Academic Societies Meeting, Toronto, Canada, May.

Levy L., Kafri R., Malkin D., 2018, mTOR inhibition increases lifespan in Li-Fraumeni Syndrome fibroblasts by positively influencing the DNA damage response, 255th National Meeting of the American Chemical Society, New Orleans, LA, March.

Linfield T., Park H. E., Menon D., Montaner S., 2018, ANGPTL4 promotes lymphangiogenesis in head and neck squamous cell carcinoma, 255th National Meeting of the American Chemical Society, New Orleans, LA, March.

Chawla, A., Futran, D., Liriano, R., Mallari, K., Mertil, F., **Radinsky, I**., Schuster, R., and Ta, T., 2017, Student trajectories and school choice in the New York City public school system, MIT Conference on Digital Experimentation, October.

Gerber, N., Dubrovsky, E., Lowe, S., Brodsy, A., Kurz, E., **Marmer, M.,** Chun, J., Schwartz, S., Shapiro, R., Axelrod, D., Guth, A., and Schnabel. F., 2017, DCIS on core-needle biopsy with no residual disease at surgery, SSO Annual Cancer Symposium, WA

Rozner, S. and DiLorenzo, T., 2017. Comfort with sexuality in Orthodox Jewish women. Poster presentation, Annual Meeting of the Society of Behavioral Medicine, San Diego, CA.

Saffern, M.S., Abt, M.C., Pamer, E.G., 2017, Role of IL-17a in fecal microbiota transplant mediated clearance of *C. difficile* infection, 253rd National Meeting of the American Chemical Society, San Francisco, CA, April.

Levy, L., Chernichovski, T., and Schwartz, I., 2017, Male sex hormones regulate human endothelial nitric oxide synthase system through the modulation of cationic amino acid transporter-1, 253rd National Meeting of the American Chemical Society, San Francisco, CA, April.

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2017, DCIS on core-needle biopsy with no residual disease at surgery, Society of Surgical Oncology Annual Cancer Symposium, WA, March

Berman, A.Y., Alayev, A., Salamon, R.S., Berger, S.M., Schwartz, N.S, Cuesta, R., and Holz, M.K., 2016, Raptor mediated mTORC1 phosphorylation of ERα in breast cancer, 251st National Meeting of the American Chemical Society, San Diego, CA, March.

Wiener, S.L., Berman, A.Y., Alayev, A., Salamon, R.S., Sun, Y., Schwartz, N.S., Yu, J.J., and Holz, M.K., 2016, The combined effects of resveratrol and rapamycin in TSC null diseases, 251st National Meeting of the American Chemical Society, San Diego, CA, March.

Meyers, D., Martinez, K., and Chang, E.B., 2016, Understanding impaired lipid absorption in germ free mice, 251st National Meeting of the American Chemical Society, San Diego, CA, March.

Wakschlag, N. and DiLorenzo, T., 2016, The association between modest dress and body image in Orthodox Jewish Women. Poster presentation, Annual Meeting of the Society of Behavioral Medicine, Washington, D.C.

Li, Y., Korobko, R., **Lerner**, A., Lubomirsky, I., and Frenkel, A.I., 2015, Origin of giant electrostriction in Gd doped ceria revealed by differential QEXAFS, XAFS-15 International Conference, Karlsruhe, Germany, August.

Applebaum, K., recipient of the 2015 UAN Student Travel Award to attend the American Society for Biochemistry and Molecular Biology Annual Meeting, March 28- April 1, Boston Exhibition and Convention Center, MA

Kramer, M.Y., McNabb, N.A., Guillette, L.J., Jr., and Kohno, S., 2015, The potential impacts of environmental endocrine disruptors on reproductive development, 249th National Meeting of the American Chemical Society, Denver, CO.

Gross, R.A., Wooten, A.L., Lewis, Woodard, P., and Lapi, S., 2015, Manganese-52: cyclotron production and PET/MR imaging, 249th National Meeting of the American Chemical Society, Denver, CO.

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Kaufman, C., Fulop, T., Boolbol, S.K., Naam, S., Gillego, A., and Chadha, M., 2014, Are more frequent early follow up mammogram protocols necessary after breast-conserving surgery and radiation therapy, San Antonio Breast Cancer Symposium, Dec.

DiLorenzo, T., Freyberg, R, and **Siegel, A**. 2014, Sex education and adherence to sexual health recommendations in Orthodox Jewish Women. Poster presented at the Society of Behavioral Medicine Annual Meeting, Philadelphia, PA, April.

Siegel, A., DiLorenzo, T., Freyberg, R., and Donath, S., 2014, Factors associated with adherence to gynecologic screening recommendations in young Orthodox Jewish Women. Poster at the Society of Behavioral Medicine Annual Meeting, Philadelphia, PA, April.

Lerner, **A**., Li, Y., Frenkel, A.I., Korobko, R., and Lubomirsky, I., 2014, The origin of giant electrostriction in Gd-doped ceria as studied by modulation excitation x-ray absorption spectroscopy, Meeting of the American Physical Society, Denver, CO.

Herskowitz, J., Victor, R., and Mintzer, E., 2014, Daptomycin interactions with TOCL containing membranes, 247th American Chemical Society National Meeting, March, Dallas, TX.

Schoor, Y. and Jordan, B.A., 2014, Prr7 is a novel regulator of the transcription factor, c Jun, in neurons, 247th American Chemical Society National Meeting, March, Dallas, TX.

Tishbi, N. and Mintzer, E., 2014, Surface and membrane binding properties of the lipopeptide daptomycin, 247th American Chemical Society National Meeting, March, Dallas, TX.

Tishbi, N. and Rapp, C., 2014, The role of sulfation in the CCR5 chemokine receptor complex, 247th American Chemical Society National Meeting, March, Dallas, TX.

Goldsmith, A., Bryan, R., Broitman, J., and Dadchova, E., 2014, Modification of antibody 2556 recognizing HIV protein gp41 with CHXA ligand for radiolabeling and radioimmunotherapy 247th American Chemical Society National Meeting, March Dallas, TX.

Hseih, S.J., Levi, D., Prince, D., Mills, M., Dayton, C., Shah, R., **Zibak, F., Shamsian, J**., and Gong, M.N. 2014, Staged implementation of the ABCDE bundle improves ICU patient outcomes, Amer. Thoracic Soc., Meeting (abstract).

Hseieh, S.J., Hope, A., Dayton, C., Gershengorn, H., Shah, R., **Shamsian, J., Zibak, F**., and Gong, M.N., 2014, The association between pre-ICU frailty and ICU delirium, Amer. Thoracic Soc., Meeting (abstract).

Weisburg, J.H., Schuck, A.G., **Greenbaum, R.E., Golfiez, M.D., Segal, J.R., Weiss, R.A., Liebman, E.C.**, Zuckerbraun, H.L., and Babich, H., 2013, Grape seed extract, a Mild prooxidant selectively cytotoxic to cancer cells. American Institute for Cancer Research Annual Meeting. Bethesda, MD.

Bonner, C., and DiLorenzo, T., 2013, A review of the literature on cognitive-behavioral therapy for anxiety and depression in school settings. Ferkauf Graduate School of Psychology, Behavioral Sciences Student Research Conference.

Donath, S., and DiLorenzo, T., 2013, Remediating academic impacts of early neglect. Ferkauf Graduate School of Psychology, Behavioral Sciences Student Research Conference.

Farzan, Y., and Freyberg, R., 2013, Effects of affect on prosocial behavior: A review of the literature. Ferkauf Graduate School of Psychology, Behavioral Sciences Student Research Conference.

Frenkiel, L., and DiLorenzo, T., 2013, Spiritual and religious coping in cancer patients. Ferkauf Graduate School of Psychology, Behavioral Sciences Student Research Conference.implications of type of trauma, level of exposure, and individual vulnerability. Ferkauf Graduate School of Psychology, Behavioral Sciences Student Research Conference.

Last, T., and Freyberg, R., 2013, Cyberbulling: Predictive factors and harmful effects. Ferkauf Graduate School of Psychology, Behavioral Sciences Student Research Conference.

Pasternak, E., and Bacon, J., 2013, A modified sound localization task as a sensitive test of processing speed in multiple sclerosis patients. Ferkauf Graduate School of Psychology, Behavioral Sciences Student Research Conference.

Siegel, A., and DiLorenzo, T., 2013, Are knowledge, family and friend history of disease and perceived risk predictive of the uptake of gynecologic health recommendations in orthodox Jewish women? Ferkauf Graduate School of Psychology, Behavioral Sciences Student Research Conference.

Yarmush, D., and Freyberg, R., 2013, The effect of music on cognitive, verbal, and task performance. Ferkauf Graduate School of Psychology, Behavioral Sciences Student Research Conference.

Schuck, A.G., **Wargon, S.E., Tauber, L., Miller, S.H., Weinstock, H.R.,** Weisburg, J.H., Zuckerbraun. H.L., and Babich, H. 2013. Ellagic and gallic acids, dietary polyphenols with selective cytotoxicity to oral carcinoma HSC-2 cells. Society for In Vitro Biology Annual Meeting, Providence, RI

Tishbi, N. and Mintzer, E., 2013, Surface and membrane binding properties of the lipopeptide daptomycin, 57th Annual Meeting of the Biophysical Society, Philadelphia, PA

Joel, K., Kollmar, D., and Santos, L. F 2013, Spectrum, symmetries, and dynamics of Heisenberg spin-1/2 chains (oral presentation), International Meeting of the American Physical Society, March Meeting, Baltimore, MD.

Kollmar, D. and Santos, L. F 2013, Invariant correlation entropy as a signature of quantum phase transitions in spin-1/2 systems (oral presentation), International Meeting of the American Physical Society, March Meeting, Baltimore, MD.

Laufer, T.S. and Rapp, C. 2013, Effects of tyrosine *o*-sulfation on binding affinity in CXCR4-SDF-1 complexes, 245th National Meeting of the American Chemical Society, New Orleans, LA.

Snow, S. and Rapp, C., 2013, Role of tyrosine *o*-sulfation in the CXCR4-SDF-1 chemokine receptor complex, 245th National Meeting of the American Chemical Society, New Orleans, LA.

Robin, E.F., Wietschner, J.K., Zuckerbraun, H.L., Babich, H., Schuck, A.G., and Weisburg, H.J., 2013, Gallic acid, an inducer of apoptosis to human oral carcinoma HSC-2 cells as mediated through oxidative stress, 245th National Meeting of the American Chemical Society, New Orleans, LA.

Schoor, Y. and Velisek, 2013, Different route of administration for melanocortin receptor agonist, melanotan II, in the model of cryptogenic infantile spasms, 245th National Meeting of the American Chemical Society, New Orleans, LA.

Weinstein, A., Baker, M.E.R., Hughes, C.M., Allis, D., McEwen, B.S., and Hunter, R.G., 2013, Evidence for the role of a novel histone mark in hippocampal neurogenesis**,** 245th National Meeting of the American Chemical Society, New Orleans, LA.

Sedletcaia, A., **Unger, H.A.,** Maruani, D.M., and Holz, M.K., 2012, New targets of mTORC1 pathway in ER-positive cells, American Association for Cancer Research Annual Meeting, Chicago, IL.

Chitgarha, M.T, Khaleghi, S., Daab, W., Ziyadi, M., Mohajerin-Ariaei, A., **Rogawski, D**., Tur, M., Vusirikala, V., Zhao, W., Touch, J., and Willner, A.E. 2012. Demonstration of WDM OSNR Performance Monitoring and Operating Guidelines for Pol-Muxed 200-Gbit/s 16-QAM and 100-Gbit/s QPSK Data Channels. Optical Fiber Communication Conference and Exposition (OFC).

Amram, R., and DiLorenzo, T., 2012, Prevalence and pedictors of academic dishonesty. Poster to be presented at the Annual Meeting of the American Psychological Association, Orlando, Fl.

Freyberg, R., and **Bart, M**., 2012, Olfactory environment influences close relationships through multiple methods of measurement. Poster presented at

the Annual Conference of the Association of Chemoreception Sciences, Huntington Beach, CA.

Gofine, M., and Dilorenzo, T., 2012, How are we doing? A review of assessments within writing centers. Ferkauf Graduate School of Psychology, Behavioral Sciences Student Research Conference.

Michalowksi, A., and Freyberg, R., 2012, The effect of directed writing on depression and anxiety. Ferkauf Graduate School of Psychology, Behavioral Sciences Student Research Conference.

Pasternak, E., and Bacon, J., 2012, Demystifying insight: A review. Ferkauf Graduate School of Psychology, Behavioral Sciences Student Research Conference.

Zughaft, M., Taylor, D.J., and Harburger, L.L., 2012, Effects of endogenous and exogenous sex hormones on object memory and spatial ability in young and aged women. 16th Annual N.E.U.R.O.N. Conference Program.

Zughaft, M., Taylor, D., and Harburger, L., 2012, Effects of endogenous and exogenous sex hormones on object memory and spatial ability in young and aged women. Ferkauf Graduate School of Psychology, Behavioral Sciences Student Research Conference.

Gharagozloo, P., Arcasedda, F., Khatamee, M., Gutierrez-Adan, A., Drevet J., Krey, L., **Mandelbaum, M.,** Smith, M., Kramer, Y., Sanchez, X., Lu, L., McCaffrey, C., and Grifo, J., 2012, Age, sperm, & oocyte stress and infertility, American College of Obstetricians and Gynecologists, May 8th, San Diego, CA

Vigodner, M., Nieves,E., Shrivastava, V., Callaway, M.B., **Marmor, H.,** and **Chernyak, S.-B**., 2012, Identification of sumoylated proteins in human sperm, American Society of Andrology (ASA) 37th Annual Conference, April 21 – 24, Tucson, Arizona.

Hachen, M., Hunter, R.G., Pfaff, D.W., and McEwen, B.S., 2012, Stress modulates mitochondrial gene expression in the rat hippocampus, 243rd American Chemical Society Meeting, San Diego, California, Spring semester.

Gubin A. and Santos L.F., Quantum Chaos: An introduction via chains of interacting spins 1/2, Oral presentation, March Meeting 2011, American Physical Society, Boston, MA.

Karp, E., Novikov, L., **Klerman, H.**, and Gamble, M.J., 2012, Understanding the role of intronic cis-acting elements in the splicing of macroH2A1 variants, 243rd American Chemical Society meeting, San Diego, California, Spring semester.

Wolf, B.J., Reiss, S.E., Babich, H., Weisburg, J.H., Schuck, A., and Zuckerbraun, H., and **Fertel, S.** 2012, Proapoptotic effects of ellagic acid, a metabolite of pomegranate extract, on human oral carcinoma HSC-2 cells, 243rd American Chemical Society meeting, San Diego, California, Spring semester, 2012.

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Hachen, M., Hunter, R.G., Pfaff, D.W. and McEwen, B.S., 2011, Stress modulates mitochondrial gene expression in the rat hippocampus, Society for Neuroscience Abstracts, Washington, D.C.

Shrivastava, V., **Marmor**, **H**., **Gutstein**, **L**., Chernyak, S.-B., and Vigodner, M., 2011, SUMO proteins may regulate multiple functions in human sperm which can be significantly affected by cigarette smoke, FAMRI Web Symposium.

Bart,M., and Freyberg, R., 2011, Fragrance change impacted interactions of close femalefriends. Chemical Senses, 36, A100-101.

Bacon, J., Kalina, J., Bochkanova, A., **Ausubel-Strauchler, Y.** and Herbert, J., (2011). Cognitive rehabilitation benefits multiple sclerosis patients only if they are active participants in the program. Neurology, 76 (S4): A85.

Harburger, L.L. and **Taylor, D.J.,** (2010). The effects of age on object memory and spatial ability in women. Society for Neuroscience Abstracts,Program # 605.2.

Huisman, T., Chatterjee, S., Volpi, S., and Birshtein, B., 2011, AID and Gadd45a: Involved in active DNA demethylation of the 3'RR and in class switch recombination? 241st American Chemical Society National Meeting, Anaheim, CA, March.

Rogawski, R. and Mintzer, E., 2011, Elucidating the interaction of LPA with model membranes, 241st American Chemical Society National Meeting, Anaheim, CA, March

Rosenblatt, K., Avogadri, F., Li, Y., Murphy,J., Merghoub, T., Houghton, A., and Wolchok, J., 2011, Detection of TRP-2 antibodies in the serum of TRP-2 immunized mice, 241st American Chemical Society National Meeting, Anaheim, CA, March.

Schuck, A.G., **Cohen, S.S., Lerman, L.T., Haken, O.,** and Weisburg, J.H., 2011, Pomegranate and olive fruit extracts, prooxidants with antiproliferative and proapoptotic activities towards HSC-2 carcinoma cells. Society for In Vitro Biology Annual Meeting, Raleigh, NC, June

Hasten, E., Lazaros, J., and Schuck, A.G., 2011, Pro-oxidant and pro-apoptotic activities of olive fruit extract toward oral carcinoma cells. Columbia University Undergraduate Research Symposium, April.

Hirth, Y.A., Zuckerbraun, H.L., and Weisburg, J.H., 2011, Decrease in intracellular glutathione and induction of apoptosis in HSC-2 carcinoma cells from the human oral cavity due to pomegranate juice extract. Society for In Vitro Biology Annual Meeting, Raleigh, NC, June

Schneider, J., Gutstein, L., Shrivastava, V., and Vigodner, M., 2011, SUMO proteins may regulate head reshaping, capacitation, and stress response in human sperm, Columbia University Undergraduate Research Symposium, Spring, April.

Hirth, Y.A., Zuckerbraun, H.L., and Weisburg, J.H., 2011, Decrease in intracellular glutathione and induction apoptosis in HSC-2 carcinoma cells from the human oral cavity due to pomegranate juice extract. Society for In Vitro Biology Annual Meeting, Raleigh, NC, June

Schneider, J., Gutstein, L.E., Shrivastava, V., and Vigodner, M. 2011, SUMO proteins may regulate head reshaping, capacitation, and stress response in human sperm, XXIst North American Testis Workshop, Montreal, Quebec, Canada, 3/30-4/2.

Maruani, M., **Harris, E., Shachter, A.,** and Holz, M.K., 2011, Co-regulatory relationship between estrogen receptor alpha and the mTOR/S6K1 signaling pathways, American Association for Cancer Research 102nd Annual meeting, Orlando, FL, April.

Schneider, J., Gutstein, L., Shrivastava, V., and Vigodner, M., 2011, SUMO proteins May regulate head reshaping, capacitation, and stress response in human sperm, Columbia University Undergraduate Research Symposium, Spring.

Gross, J., Ennis, R.D., Homel, P., Evans, A., Gliedman, P., Choi, W., Hu, K., Shasha, D., Harrison, L.B., and S. Fleishman, 2010, The rapid increase in radiation oncology consultation and treatment of the extreme elderly and its independence from population growth, America Society for Radiation Oncology (ASTRO) Annual Meeting.

Marinkovic, N., Wang, Q., Barrio, **Cooper**, C., and Frenkel, A.I., 2010, Synchronous XAFS/DRIFTS Study of CO adsorption on Al2O3-supported Pt clusters The First North American Core Shell Spectroscopy Conference, Denver, CO.

Donington, J.S., Blasberg, J.D., Goparaju, C.M.V., **Hirsch, N.**, and Pass, H.I., 2010, Molecular heterogeneity of osteopontin Isoforms in non-small cell lung cancer, American Association of Cancer Research, International Association for the Study of Lung Cancer Joint Conference on Molecular Origins of Lung Cancer, Coronado, CA.

Goparaju, C., Donington, J., **Hirsch, N.**, Harrington, R., and Pass, H.I., 2010, EphB2 expression parallels malignant behavior in mesothelioma, American

Association of Cancer Research, 101st Annual Meeting, Washington, D.C.

Donington, J.S., Goparaju, C.M.V., Blasberg, J.D., **Hirsch, N.**, Harrington, R,, Pass, H.I., and Neubert, T., 2010, Extracellular mediation of divergent impact of OPN splice variants in non-small cell lung cancer, Osteopontin Biology, FASEB Summer Research Conference, Steamboat Springs, CO.

Donington,. J.S., Blasberg, J.D., Goparaju, C.M.V., **Hirsch, N.**, Harrington. R., and Pass, H.I., 2010, Argatroban inhibition of osteopontin modulates isoform specific malignant properties in non-small cell lung cancer. 10th Targeted Therapy meeting, Santa Monica, CA (presented but not published).

Gross, J., Ennis, R.D., Homel, P., Evans, A., Gliedman, P., Choi, W., Hu, K., Shasha, D., Harrison, L.B., and S. Fleishman, 2010, The rapid increase in radiation oncology consultation and treatment of the extreme elderly and its independence from population growth, America Society for Radiation Oncology (ASTRO) Annual Meeting.

Horowitz, D. and Dilorenzo, T., 2010, The efficacy of hypnosis in pediatric cancer care, Ferkauf Graduate School of Psychology, Behavioral Sciences Student Research Conference.

Stiefel, E. and Freyberg, R., 2010, Trying to remember: A literature review about improving eye-witness testimony, Ferkauf Graduate School of Psychology, Behavioral Sciences Student Research Conference.

Rollhaus, E. and Freyberg, R., 2010, An analysis of the effects of altering directives in narrative therapy, Ferkauf Graduate School of Psychology, Behavioral Sciences Student Research Conference.

Scholl, C. and Dilorenzo, T., 2010, The issue of "faking good" on self report personality measures in personnel selection, Ferkauf Graduate School of Psychology, Behavioral Sciences Student Research Conference.

Zitter, S., Bryk, D., Fox, A., Narlieva, M., Pan, Q., Chang, T., Cloherty, G., and Lucic, D., 2010, Swine influenza or seasonal influenza? The first clinical adaptation of an automated open platform for swine influenza. The Montefiore experience, Young Research Investigators Symposium at Montefiore Medical Center, Bronx, NY, **third place winner.**

Shrivastava,V., **Miller, R., Lazaros, S.H.,** and Vigodner, M., 2010, Sumoylation as a sensitive marker of a tobacco-induced oxidative stress in the testis, FAMRI meeting, Miami, Florida (May)

Deluty, J., Seto, J., and Sealfon, S., 2010, Elucidating the signaling pathways of the immune response in monocytes, Columbia University Undergraduate Research Symposium, Spring.

Dinerman, J. and Santos, L.F., 2010, Controlling the Evolution of a Quantum

System with Dynamical Decoupling Methods, Oral presentation, March Meeting, American Physical Society, Portland, OR.

Holz, M.K., **Seligman F.F., Spiegel T.N.,** and **Maruani D.M.,** 2010, Estrogenic regulation of S6 kinase 1 expression creates a positive feed-forward loop in control of breast cancer cell proliferation, AACR 101st Annual Meeting, Washington, DC.

Huisman, T. and Hodgson, L., 2010, Spectral modification to genetically encoded single-chain RhoA biosensor, 239th National Meeting, American Chemical Society, San Francisco, CA

Liebling, E.J., Asenjo, A.B., De Paoli, V.M., Rath, U., Sharp, D. J., and Sosa, H., 2010, Interactions between microtubules and kinesin-1,3, 239th National Meeting, American Chemical Society, San Francisco, CA

Mintzer, E., and **Rogawski, R.,** 2010, Elucidating the interaction of LPA with model membranes, Columbia University Undergraduate Research Symposium, Spring.

Solodokin, L.J., **Canter, A., Freilich, A., Haken, O., Ovits-Levy**, **C.G.,** Schuck, A.S., and Babich, H., 2010, Anticarcinogenic and prooxidant properties of pomegranate juice extract and olive fruit extract, Columbia University Undergraduate Research Symposium, Spring.

Weiss, R.S., *Zhang, C., and Cuervo, A.M., 2010,* **Identification of markers for autophagy in serum,** 239th National Meeting, American Chemical Society, San Francisco, CA

Yamnik, R.L. and Holz, M.K., 2009, mTOR/S6K1 and MAPK/RSK signaling pathways coordinately regulate estrogen receptor alpha serine 167 phosphorylation, Cancer Res., 69:A31S

Holz. M.K., **Digilova, A., Yamnik, R., Davis, D.,** Murphy. C., and **N. Brodt**, 2009, Estrogen receptor alpha is a target of mTOR/S6K1 signaling in control of breast cancer cell proliferation, Cancer Res. 69:269S (abstract).

Bellman, A. and DiLorenzo, T, 2009, The association between feminism, religiosity, and psychological well-being in Jewish women, Yeshiva University Behavioral Sciences Student Research Conference.

Ganz, D, and DiLorenzo, T, 2009, Comorbid suicidality and alcohol abuse in adolescents: Etiologic factors, Yeshiva University Behavioral Sciences Student Research Conference.

Hanau, T. and DiLorenzo, T, 2009, Etiology and treatment of bulimia nervosa, Yeshiva University Behavioral Sciences Student Research Conference.

Hazan, R. and DiLorenzo, T, 2009, Prolonged/imaginal exposure in PTSD: A literature review, Yeshiva University Behavioral Sciences Student Research Conference.

Hazan, R. and R. Freyberg, 2009, Victim of the act or the offender? Exploring the emotional and psychological responses of sexual assault and rape victims based upon the victim-offender relationship, Yeshiva University Behavioral Sciences Student Research Conference

Miller, R. and Harburger, L, 2009, Does Ben Franklin Effect increase with effort? Yeshiva University Behavioral Sciences Student Research Conference

Reichman, D. and DiLorenzo, T, 2009, Influence of family support on PTSD in children, Yeshiva University Behavioral Sciences Student Research Conference.

Rollhaus, E., and R. Freyberg, 2009, Directives in Narrative Therapy, Yeshiva University Behavioral Sciences Student Research Conference

Sonenberg, R. and DiLorenzo, T, 2009, A review of the literature on the psychological effects of 9/11 in children, Yeshiva University Behavioral Sciences Student Research Conference.

Spiegel, T. and DiLorenzo, T, 2009, Does MRI screening have a negative psychological effect on women who carry the BRCA gene? Yeshiva University Behavioral Sciences Student Research Conference.

Stiefel, E. and R. Freyberg, 2009, The multi-faceted Jew: A study on the integration of the interdependent self and the independent self in Jews in America, Yeshiva University Behavioral Sciences Student Research Conference

Dinerman, C., Keller, and B. Herold, 2009, Genital secretions confer anti-*E. coli* activity, Montifiore Pediatric Research Day, 1St prize for a student poster.

Dukesz, F., **Zilbergerts, M.,** and L. F. Santos, 2009, Interplay between interaction and (un)correlated disorder in Heisenberg spin 1/2 chains, March Meeting of the American Physical Society, Pittsburgh

Ackerman, N.J., Burekhovich, F., Schuck, A.G., Zuckerbraun, H.L., and H. Babich, 2009, *Gingko biloba* leaf extract induces oxidative stress in HSC-2 carcinoma cells, Columbia University Symposium of Undergraduate Research, Spring. (abstract and oral presentation).

Ruderman, E., Zack, E., and A.G. Schuck**,** 2009, Antitumorigenic and prooxidant activities of blueberry extract to human oral cancer cells, Columbia University Undergraduate Research Symposium, Spring. (abstract).

Bromberg, M.R., Patolla, A., Wang, O., Segal, R., Han W.-Q., Feldman, I., Zypman, F.R., Iqhal, Z., and A.I. Frenkel, 2009 , Platinum nanoparticles on SWNT nanopaper support: Synthesis, characterization, and application in electrocatalysis, The 237th American Chemical Society Meeting, Salt Lake City, Utah, March (abstract)

Charles, G., and E.A. Mintzer, 2009, Comparison of the behavior of native cholesterol and two oxidized cholesterol derivatives, The 237th American Chemical Society Meeting, Salt Lake City, Utah, March (abstract)

Charles, G. and E.A. Mintzer, 2009, Oxysterols alter the propensity of lipid raft formation in model membranes, Columbia University Undergraduate Research Symposium, Spring. (abstract).

Herzberg, B.M., Ting, L.-M., Mwakingwe, A., Croken, M.M., Madrid, D., Hochman, S., and K. Kim, 2009, Genetic studies of adenosine deaminase in the rodent malaria parasites, *Plasmodium yoelii* and *Plasmodium berghei*, The 237th American Chemical Society Meeting, Salt Lake City, Utah, March (abstract)

LeVee, A.J., and E.V. Prodan, 2009, Molecular electronics: Tunneling devices with semiconducting leads, The 237th American Chemical Society Meeting, Salt Lake City, Utah, March (abstract)

Liebling, E., Burger, R.F., Zuckerbraun, H.L., Schuck, A.G., and H. Babich, 2009, Protective effects of pyruvate through mediation of oxidative stress, Columbia University Symposium of Undergraduate Research, Spring (abstract).

Merzel, M., Grace, M., and M. Balwani, 2009, Development and validation of a dried blood spot assay for chitotriosidase, an important biomarker for Gaucher Disease, The 237th American Chemical Society Meeting, Salt Lake City, Utah, March (abstract)

Pekar, M., Grosser, E., Goodfriend, G., Im, J. and M.Vigodner, 2009, Stress-induced response and apoptosis in germ and somatic testicular cells: involvement of SUMO proteins, Columbia University Symposium of Undergraduate Research, Spring (abstract).

Schiffmiller, A., Rapp, C., Kalyanaraman, C., and M. Jacobson, 2009, Theoretical ranking of a congeneric series of protein kinase inhibitors, Columbia University Symposium of Undergraduate Research, Spring.(abstract)

Holz, M.K., **Digilova, A., Yamnik, R., Davis, D**., Murphy, C., and **N. Brodt,** 2008, The role of S6 kinase 1 in breast cancer, San Antonio Breast Cancer Symposium

Atlas, A., McCarthy, J.W., and M. Feldmesser, 2008, *Aspergillus fumigatus* proteins bound by a germination-inhibitory monoclonal antibody, National Meeting of the American Chemical Society, New Orleans, LA.

Bellman, A. and T. DiLorenzo, 2008, Gender Identity Disorder: A review of the literature. Ferkauf Graduate School of Psychology Behavioral Sciences Student Research Conference

Blau, L., Estes, D**., Seleski, N.** and **S.A**.**Guigui,** 2008, Stabilizing of deoxyoligonucleotide duplexes by base stacking, National Meeting of the American Chemical Society, New Orleans, LA.

Clark, E., Seideman, J., Silverman, J., Gardner, J., Scheinberg, D.A., and J.H.Weisburg, 2008, P-Glycoprotein independent resistance to oxidative stress in leukemia cells, National Meeting of the American Chemical Society, New Orleans, LA.

Dukesz, **F.,** Frenkel, A.I., Bromberg, M.R.,Wang, O., Asherie, N., Blass, S., Rafailovich, M.H., Sun, Y., and J. Kang, 2008, Comparing various methods of synthesis and analysis of gold nanoparticles, National Meeting of the American Chemical Society, New Orleans, LA.

Fathy, J., Seleski, N., Dinerman, E., and M.Vigodner, 2008, Expression of SUMO protein in normal testicular cells and germ cell tumors, Columbia University Spring Undergraduate Research Symposium.

Feldman, A., Benichou, C., Skop, N., and M.Vigodner, 2008, Heat-induced stress response in germ and somatic testicular cells: involvement of SUMO proteins, Columbia University Spring Undergraduate Research Symposium

Freyberg, R., and **M**.**Bensoussan,** 2008, The impact of fragrance on social relationships. Poster presented at the 2008 Biannual Conference on Human Development, Indianapolis, IN.

Freyberg, R., **Bensoussan, M.,** and A. **Silver,** 2008, Disruption of olfactory environment impacts close relationships in young women. National Meeting of the International Symposium of Olfaction and Taste, San Francisco, CA.

Greer, D. and R. Freyberg, 2008, Personality type as a predictor of religious identity and conflicts, Yeshiva University Behavioral Sciences Student Research Conference

Guigui, S.A., House, R., Dulyaninova, N. and A. Bresnick, 2008, Characterization of a scfv to non-muscle myosin-II, National Meeting of the American Chemical Society, New Orleans, LA.

Hazan, R., and T. DiLorenzo, 2008, Treatment methods for PTSD: A literature review, Yeshiva University Behavioral Sciences Student Research Conference

Herzberg, B.M., Ramjeawan, R., Sun, Y., Frenkel, A.I., and M. Rafailovich, 2008, Characterizing protein and folate coated nanoparticles and analyzing their toxic effects on cancerous and normal keratinocytes, National Meeting of the American Chemical Society, New Orleans, LA.

Liebling, E.J., Gottesman, R.T., Citrin, N.S., and H. Babich, 2008, Prooxidant ability of black tea flavin monogallates: studies with carcinoma and normal cells, ColumbiaUniversity Spring Undergraduate Research Symposium.

Oxman, H., and T. DiLorenzo, 2008, Validity of MMPI-2 L scores in Orthodox Jewish undergraduate females. National Meeting of the American Psychology Association, Boston, MA.

Raviv, T., Digilova, A., and A. Schuck, 2008, Synergistic interactions between black tea theaflavins and chemotherapeutics in oral cancer cells, Columbia University Spring Undergraduate Research Symposium. (Note: **Tehilla Raviv and Alla Digilova** also presented this research as an oral presentation).

Reichman, B., and R. Freyberg, 2008, The unique developmental issues and challenges of children with incarcerated mothers, Yeshiva University Behavioral Sciences Student Research Conference

Rollhaus, E., and R. Freyberg, 2008, Effects of written disclosure on mental health, Yeshiva University Behavioral Sciences Student Research Conference

Segal, L., and R. Freyberg, 2008, Social aspects of religious influence on youth, Yeshiva University Behavioral Sciences Student Research Conference

Silver, A., and R. Freyberg, 2008, Unfamiliar fragrances and their effects on nonverbal communication, Yeshiva University Behavioral Sciences Student Research Conference

Stiefel, E., and R. Freyberg, 2008, To co-sleep or separate sleep that is the question: Reasons and developmental effects of co-sleeping vs. separate sleeping, Yeshiva University Behavioral Sciences Student Research Conference

Bacon, J., Fromm, J.T., **Adelman, M., Neuhaus, R**., and J. Herbert, 2007, Targeted cognitive interventions improve cognitive functioning in patients with MS. Int. J. MS Care. 9:P13.

Bacon J, Fromm J, **Neuhaus R**, and J. Herbert, 2007, Cognitive interventions to improve cognitive functioning in patients with multiple sclerosis, Mult. Scler. (Suppl 2). 13:S232.

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Improving quality of life through participation in self-management interventions. Int. J. MS Care. 9: S41.

Fromm, J.T., Bacon, J., **Adelman, M**., Steinberg, C., and J. Herbert, 2007, Clutter management in MS: Integrated occupational therapy approach. Int. J. MS Care. 9: S40.

Balk, E. and T. DiLorenzo, 2007, Risk factors for attrition in intervention programs for conduct disorder, Yeshiva University Behavioral Sciences Student Research Conference.

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Seidenwar, L. and T. DiLorenzo, 2007, The effects of ADHD on parental functioning, Yeshiva University Behavioral Sciences Student Research Conference.

Weiser, A. and R. Freyberg, 2007, The interplay between self-esteem, marital satisfaction, and perceived peer rejection in middle adulthood, Yeshiva University Behavioral Sciences Student Research Conference

Krupka, C.B., and R. Freyberg, 2007, The impact of Judaism and SES on substance use, Yeshiva University Behavioral Sciences Student Research Conference

Glaser, E., and R. Freyberg, 2007, The effects of religious service attendance on well-being, Yeshiva University Behavioral Sciences Student Research Conference

Bensoussan, M., and R. Freyberg, 2007, The nature of fragrance preferences in young women, National Meeting of the Association of Chemoreception Sciences, Sarasota, FL.

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Zimmerman, R. and R. Freyberg, 2007, Effects of Ken Doll on body image of preadolescent males, Yeshiva University Behavioral Sciences Student Research Conference

Marmor, R.A., Fathy, J., Vigodner, M., and J.H. Weisburg, 2007, Differential expression pattern of SUMO proteins in normal and drug-resistant HL-60 cancer cell lines, Proceedings of the Columbia University Spring Undergraduate Research Symposium (poster presentation/abstract).

Guigui, S.A., Estes, D., and L. Blau, 2007, DNA's stability: composition vs. sequence, 233rd American Chemical Society National Meeting, Chicago, IL. (poster presentation/abstract).

Bursky-Tammam, N., **Platt, Y., Bram, A., Kanner, L., Simpser, M**., Zhou, J., Zhao, S., Rafailovich, M., and A. Frenkel, 2007, EXAFS analysis of hydrogenation effects on the structure of Pd nanacatalysts, 233rd American Chemical Society National Meeting, Chicago, IL. (poster presentation/abstract).

Brodt, N., Yamnik, R.L., Blenis, J., and M.K. Holz, 2007, Increased S6K1 protein expression confers proliferative advantage and rapamycin sensitivity to human mammary cancer cells, 233rd American Chemical Society National Meeting, Chicago, IL. (poster presentation/abstract).

Eisner, R., Schonbrun, C., Huang, N., and C. Rapp, 2007, Force field based receptor ligand rescoring, Mid-Atlantic Regional Meeting of the American Chemical Society (poster presentation/abstract).

Frenkel, A.I., Menard, L.D., Northrup, P., Rodriquez, J.A., Zypman, F., **Glasner**, **D**., Gao, S.-P., Xu, H., Yang, J.C., and R.G. Nuzzo, 2006, *Geometry and charge state of mixed-ligand Au13 nanoclusters* , XAFS XIII Conference, Stanford, CA.

Bacon, J., **Riber, L**., Fromm, J.T., **Safier, M**., and J. Herbert, 2006, Motivational style as a predictor of adherence to injection therapy for multiple sclerosis. Mult. Scl. (Suppl 1) 12:S117.

Weller, I. and R. Freyberg, 2006, Application of a learning theory framework on to improving self-esteem and treatment outcomes of substance use disorders, Yeshiva University Behavioral Sciences Student Research Conference

Etengoff, C., and R. Freyberg, 2006, Judeo-Christian values and the female body image, Yeshiva University Behavioral Sciences Student Research Conference

Bensoussan, M., and R. Freyberg, 2006, Understanding fragrance preferences in young women.Yeshiva University Behavioral Sciences Student Research Conference

Glasner, D., and A.I. Frenkel, 2006, Geometrical characteristics of regular polyhedra: Application to EXAFS studies of nanoclusters, XAFS 13 Conference, Stanford, CA.

Ackerman, R., Weiss, T., and T. DiLorenzo, 2006, CBT: Modification of dating habits: A case study, Yeshiva University Behavioral Sciences Student Research Conference.

Dickstein, D. and T. DiLorenzo, 2006, Relationship status as a predictor of caregiver burden in traumatic brain injury, Yeshiva University Behavioral Sciences Student Research Conference.

Goldmintz, E. and T. DiLorenzo, 2006, Risk factors for maladjustment in children from divorced families, Yeshiva University Behavioral Sciences Student Research Conference.

Harris, T., Soussan, **L.,** Isseroff, R., Sun, Y., Rafailovich, M.H., and A.I. Frenkel, 2006, EXAFS studies of palladium nanoparticles: Size control and hydrogenation, XAFS13 Conference, Stanford, CA.

Pease, D.M., Frenkel, A.I., Shanthakumar, P., Huang, T., Balasubramanian, M., Budnick, J.I., Brewe, D., **Abitbol**, **N.**, and O. Odom, 2006, Performance and improved design of the log spiral of revolution monochromator, XAFS13 Conference, Stanford, CA.

Frenkel, A.I., Pease, D.M., Budnick, J., Shanthakumar, P., Huang, T., **Abitbol**, **N**., and P. Metcalf, 2006, X-Ray Absorption Fine Structure study of the metal-insulator transition in Cr doped V2O3, March Meeting of the American Physical Society, Baltimore, MD.

Sun, Y., Frenkel, A.I., Isseroff, R., **Shonbrun**, **C.,** Forman, M., Shin, K., Koga, T., White, H., Rafailovich, M., and J. Sokolov, 2006, Characterization of Palladium and Gold nanoparticles using x-ray reflectivity, EXAFS and electron microscopy, March Meeting of the American Physical Society, Baltimore, MD.

Zaghi, D., Jacobson. M., and G. Barreiro, 2006, pH Sensitivity in talin, 232nd National Meeting of the American Chemical Society, San Francisco, CA

Feig, J.L., Ha, S., Rudoff, R., and S.K. Logan, 2006, ART-27: a novel coactivator with tumor suppressor function in the prostate, 231st National Meeting of the American Chemical Society, Atlanta, GA.

Fridman, F., Erika, A., Ringia, T., and V.L. Schramm, 2006, Inhibitor screening for human nucleoside phosphorylase, bovine xanthine oxidase, and *E. coli* thymidine phosphorylase, 231st National Meeting of the American Chemical Society, Atlanta, GA.

Goldberg, M.S., Gerke, J.P., and Cohen, B.A., 2006, Correlation of gene expression and sporulation efficiency in *Saccharomyces cerevisiae*, 231st National Meeting of the American Chemical Society, Atlanta, GA.

Levine, E., Mandell, D., Jacobson, M.P., and C.S. Rapp, 2006, An implicit solvent study of phosphorylation in protein molecules, 231st National Meeting of the American Chemical Society, Atlanta, GA.

Soussan, L.L., **Harris, T., Isseroff, R.,** Sun, Y., Rafailovich, M., and A.I. Frenkel, 2006, Thiol-stabolized palladium nanoparticles: size control and hydrogenation, 231st National Meeting of the American Chemical Society, Atlanta, GA.

Estes, D.W, **Ben-Zvi, N.,** and L. Blau, 2006, The DNA melt, 19th Biennial Conference on Chemical Education, West Lafayette, IN, July.

Edelblum, R. and T. DiLorenzo, 2005, Aging: Natural buffer against the effects of multiple sclerosis, Yeshiva University Behavioral Sciences Student Research Conference.

Galian, L. and T. DiLorenzo, 2005, Pain and gender: The underlying difference, Yeshiva University Behavioral Sciences Student Research Conference.

Sweet, R. and T. DiLorenzo, 2005, Sociotropic cognitions and levels of spirituality, Yeshiva University Behavioral Sciences Student Research Conference.

Estes, D.W., **Ben-Zvi, N.,** and L. Blau, 2005, The DNA melt: Composition, sequence, and thermodynamics, Gordon Research Conference on Chemistry Education Research and Practice, Connecticut College, New London, CT, June.

Frenkel, A.I.,Pease, D.M., Shanthakumar, P., Huang, T., **Abitbol**, **N**., **Soussan**, **L**., and J. I. Budnick, 2005, X-ray absorption fine structure study of the metal-insulator transition in Cr doped V2O3*,* Fall Meeting of the Materials Research Society, Boston, MA

Sun, Y., Isseroff, R., **Shonbrun**, **C**., Forman, M., Frenkel, A.I., Shin, K., Koga, T., White, H., Rafailovich, M.H., and J.C. Sokolov , 2005, Characterization of palladium nanoparticles using x-ray reflectivity, EXAFS and electron microscopy, Fall Meeting of the Materials Research Society, Boston, MA

Nissim, H.A., **Krupka, M.E**., Zuckerbraun, H.L., and H. Babich, 2005, Differential *in vitro* cytotoxicity of (-)-epicatechin gallate to cancer and normal cells from the human oral cavity, 229th National Meeting of the American Chemical Society, San Diego, CA.

Roth, R., Ozelius, L., and L. Liu, 2005, Explanation of alternative splicing in SGCE gene, 229th National Meeting of the American Chemical Society, San Diego, CA.

Nemzer, S., **Harris, T**., **Pister, I**., **Soussan, L**., Sun, Y., Rafailovich, M., and A. Frenkel, 2005, Characterizing nanoparticle size using EXAFS and TEM, 229th National Meeting of the American Chemical Society, San Diego, CA.

Nemzer, S., **Harris, T**., **Pister, I**., **Soussan, L**., Sun, Y., Rafailovich, M., and A.I. Frenkel, 2005, Size control of thiol-stabilized gold nanoparticles: combined EXAFS and TEM characterization, 229th National Meeting of the American Chemical Society, San Diego, CA.

Pister, I., Soussan, L., Nemzer, S., Harris, T., Frenkel, A.I., Sun, Y., and M.H. Rafailovich, 2005, Size dependent changes of the local structure in dodecanethiol-stabilized gold nanoparticles, Annual Meeting of the American Physical Society, Los Angeles, March (oral presentation).

Goldmintz, Y., and T. DiLorenzo, 2004, Efficacy of selective serotonin reuptake inhibitors vs. tricyclic antidepressants in elderly melancholic depressed, Yeshiva University Behavioral Sciences Student Research Conference.

Wiesen, T., and T. DiLorenzo, 2004, Somatization in Dominican individuals, Yeshiva University Behavioral Sciences Student Research Conference.

Wright, N. and T. DiLorenzo, 2004, Social influence on women and heart disease: Perceived risk and preventive health behaviors, Yeshiva University Behavioral Sciences Student Research Conference.

Ben-Zvi, N., Juszczak, L. and J. Friedman, 2004, Unfolding and refolding of the mini- protein TC5b in a confined, cell-like environment, 227th National Meeting of the American Chemical Society, Anaheim, CA.

Douglas, E., Ravetch, J.V. and B. Diamond, 2004, Fcγ receptor expression on peripheral blood mononuclear cells in SLE, 227th National Meeting of the American Chemical Society, Anaheim, CA.

Glasner, D., Frenkel, A.I, and F.R. Zypman, 2004, Geometrical properties of metal nanoparticles, 227th National Meeting of the American Chemical Society, Anaheim, CA.

Suttner, S., Sukhu, B., and H.C. Tenenbaum, 2004, Effect of the inflammatory cytokine (IL)-1β on osteoclast formation and function in human umbilical cord blood cells, 228th National Meeting of the American Chemical Society, Philadelphia, PA

Reinman, I., Benmergui, D., and C.S. Rapp, 2004, Theoretical investigation of ligand stabilization in fatty acid binding proteins, 228th National Meeting of the American Chemical Society, Philadelphia, PA

Glasner, D., Zypman, F., and A.I. Frenkel, 2004, *G*eometric properties of metal nanoparticles, Annual NSLS Users Meeting, Brookhaven National Laboratory, May.

Frenkel, A.I., **Glasner, D.,** Zypman, F., Nuzzo, R., and L. Menard, 2004, 3D-structure of thiol-capped gold nanoparticles, Annual Meeting of the American Physical Society, Montreal, Canada.

Reingold, S.O., Gu, J., Fernandez, R. and R.L. Katz, 2003, Interphase fluorescence *in situ* hybridization (FISH) to demonstrate translocation of cyclin D1 (CCD1) gene to chromosome 14 immunoglobulin heavy chain locus (IGH) with resultant overexpression of cyclin D1 protein in a mantle cell lymphoma cell line, 225th National Meeting of the American Chemical Society, New Orleans, LA

Sedletcaia, A. and P. Cohen, 2003, Localization of PMS2 in meiotic cells, 225th National Meeting of the American Chemical Society, New Orleans, LA.

Josovitz, J., Verdier-Pinanrd, P. and S. B. Horwitz, 2003, Analysis of stathmin and MAP- 4 content in taxol resistant cell lines, 225th National Meeting of the American Chemical Society, New Orleans, LA.

Gamss, C.A., Ting, L.-M., and K. Kim, 2003, Inhibition of the purine salvage pathway in *Plasmodium falciparum*, 226th National Meeting of the American Chemical Society, NY, NY.

Frankel, R., Fischer, T. and C.S. Rapp, 2003, The effects of crystal packing on protein loop structures, 36th Middle Atlantic Regional Meeting of the American Chemical Society, Princeton, NJ

Frenkel,A.I., **Frankel, S.C.,** and T. Liu, 2003, Structural stability of giant polyoxomolybdate molecules as probed by EXAFS. XAFS XII Conference, Malmo, Sweden.

DiLorenzo, T, Erblich, J, Montgomery, G, **Ephron, R, Shaffren, M** and Bovbjerg, D, 2002, Family histories of disease and disease-specific worry: The role of perceived risk. National Meeting of the Society of Behavioral Medicine Annual Meeting, Washington, D.C.

Frankel, S.C. and A. Frenkel, 2002, Reduction of nickel oxide with hydrogen from local perspective, 223rd National Meeting of the American Chemical Society, Orlando, FL.

Kenigsberg, B., Kaufman, H. and R. Glover, 2002, Immune responses to recombinant BCG expressing carcinoembryonic antigen, 223rd National Meeting of the American Chemical Society, Orlando, FL.

Kenigsberg, B., Sedletcaia, A., Estes, D. and L. Blau, 2002, Twenty years of bonding; the Chemistry club and the ACS, 223rd National Meeting of the American Chemical Society, Orlando, FL.

Nivasch, R., Chill, J. and J. Anglister, 2002, NMR-based homology model of the interferon α receptor, 2002, 223rd National Meeting of the American Chemical Society, Orlando, FL.

Sedletcaia, A., Kenigsberg, B. and H. Babich, 2002, *In vitro* cytotoxicity of protocatechuic acid, an inducer of oxidative stress, 223rd National Meeting of the American Chemical Society, Orlando, FL.

Sedletcaia, E. Matthiesen, S.H. and B.H. Sator, 2002, Parafusion homologue in *Tetyrahymena thermophila*, 223rd National Meeting of the American Chemical Society, American Chemical Society, Anaheim, CA.

Babich, H. and **S.H. Goldstein**, 1988, Bioassays for monitoring the environment: study with arsenics, 9th Annual Meeting, Society of Environmental Toxicology and Chemistry, Arlington, VA.

Ambalu, M. and L. Blau, 1986, The study of ion fluxes across lipid bilayers, 191st National Meeting of the American Chemical Society-7th Student Affiliates Research Symposium, NY, NY.

Gutman, E.A. and L. Blau, 1985, X537A-mediated transport of calcium across phosphatidylcholine bilayers, 189th National Meeting of the American Chemical Society - 6th student Affiliates Research Symposium, Miami Beach, FL [E.A. Gutman was awarded 1st prize, Biochemistry Section].

Blau, L., **Stern R.B**., Wun, T.C., and R. Bittman, 1984, Calcium transport across phosphatidylcholine vesicles, 8th International Biphysics Congress, Bristol. United Kingdom.

Student Presentations at the National Conference of Undergraduate Research

1998: **Malka Skiba** and **Cheryl Younger**
1995: **Lauren Insel** and **Judy Ehrenberg**
1994: **Yaffa Cheslow**, **Debbie Friedman**, and **Stacey Tuckman**

Derech HaTeva, a Journal of Torah and Science

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WOMEN IN SCIENCE: ABSTRACT JOURNAL

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ILANA KARP and TZIVIA LINFIELD

Effect of inhibition of the Wnt pathway by monoclonal antibody 2F1 on 3D tumorspheres

Rachel Adama, Kelsey Suggs, and Gargi Bandyopadhyaya*

Department of Biology, Yeshiva University, New York, NY

*Corresponding Author: Gargi Bandyopadhyaya Ph.D.
gargi.bandyopadhyaya@yu.edu

Introduction

The reduction of metastatic relapse is difficult to achieve utilizing most modern-day treatments in different types of cancers. Standard cancer treatments that do not target cancer stem cells result in metastatic relapse of the disease. An efficient way of combating cancer stem cell proliferation is by designing function antibodies that block the signaling pathways which instruct the cells to divide. One such pathway is Wnt which is known to control cell proliferation and cell cycle. This pathway is mediated by the phosphorylation of LRP6, a transmembrane protein receptor that has been associated with tumor genesis and progression of metastatic disease. A number of studies have elucidated this relationship. Monoclonal antibody 2F1 (MAB2F1) was designed to bind to the extracellular domain of LRP6 in order to inhibit Wnt pathway-based signal transduction (Lee et.al). In this study we utilize an in vitro 3D cell culture method called Tumorspheres, which is a solid, spherical formation developed from the multiplication of a single cancer stem/progenitor cells in culture. These cells are easily distinguishable from single or aggregated cells by bright field microscopy. Their size can vary between less than 50 micrometers to 250 micrometers (Johnson et.al). Number of tumorspheres formed can be used to characterize the cancer stem cell portion within a population of *in vitro* cultured cancer cells. Inhibition of tumorspheres has been used to correlate with the efficacy to cancer stem cell killing. We have developed a simple method of quantifying inhibition of established tumorspheres.

Materials and Methods:

Different cancer cell lines were cultured in their specific media in ultralow attachment 24 wells plates to allow the formation of 3D spheres (Johnson et.al). 2500 cancer cells were added to each well. The formation of tumorspheres was quantified by microscopic imaging (10X magnification) after one week and only those which were larger than 100 µm were counted. After that, MAB2F1 antibody was added at the concentration of 100 µg/ml in each well. A week later, the tumorsphere numbers were recounted by microscopy

The experiment was done on the following cell lines from ATCC:
Colon cancer cells: LIM2405, SW620, HCT116, HKE3.
Breast cancer cell lines: MDA231, MET1, MCF7.
Lung cancer cell lines: H2228, A549

Result:
2F1 is able to reduce significantly the number of tumorspheres in colon, lung and breast cancer cell lines. The experiments need to be repeated a number of times at different antibody concentrations in order get meaningful data.

Conclusion and further studies:
MAB2F1 does reduce tumorsphere growth and induces killing in some cell lines significantly. This indicates that, the antibody is successfully binding to the LRP6 extracellular domain and blocking the Wnt pathway. The exact mechanism for tumor death must be studied further; whether it is apoptotic or simply due to an inability to grow remains to be seen. The long-term plan for this experiment is to measure tumorspheres in samples from cancer patients and identify if blocking LRP6 can be an efficient mechanism of treatment for that patient.

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A. Kyungwon Lee,Yang Hu, Lexi Ding, Ying Chen, Yusuke Takahashi, Robert Mott, and Jian-xing Ma. Therapeutic Potential of a Monoclonal Antibody Blocking the Wnt Pathway in Diabetic Retinopathy, Diabetes 61:2948–2957, 2012.

B. Sara Johnson, Hexin Chen, and Pang-Kuo Lo. *In vitro* Tumorsphere Formation Assays, Bio Protoc. 5; 3(3), 2013.

Quality Assurance in CT Screening for Lung Cancer

Shoshana Adler[1], Dr. David Yankelevitz[2], Dr. Claudia Henschke[2], and Dr. Maham Siddique[2]

[1]Stern College for Women, Yeshiva University, New York, NY; [2]Icahn School of Medicine at Mount Sinai, New York, NY

Lung cancer is the leading cause of cancer death both in the United States and worldwide. The use of low-dose CT scans to screen for lung cancer has now been accepted by major guideline organizations and insurers. However, national uptake of screening within the eligible population has been surprisingly low thus far. Part of the challenge that explains this poor uptake relates to the difficult learning process for interpreting the CT scans, including how to best implement practices so that the findings on CT scans, which can be numerous, are efficiently managed. Specifically, there should be as few as possible workups which involve invasive procedures for findings that ultimately turn out not to be lung cancer. It also means that all lung cancers are found early and managed appropriately so that diagnosis is not delayed.
The process that governs the management of the CT scan findings has been defined by several organizations and their processes do have some differences. The major organization is the American College of Radiology and they have named their management protocol Lung-RADS. The other protocol that is used in some institutions in the United States, as well as internationally, is called the International Early Lung Cancer Action Program (I-ELCAP). For both of these protocols, the first step is finding an abnormality on a CT scan. It is how these findings are managed that can differ between the organizations. For both protocols, it is essential that the radiologist be familiar with the options for how to proceed regarding a particular finding. This may include recommending a short term follow up CT scan to determine if a nodule is growing, recommending another test such as a PET scan, or even recommending an invasive procedure such as a biopsy. Alternatively, they could simply recommend that they patient return the following year for their next annual scan. Review of the results from multiple large studies has shown that protocols are not always carefully followed and that this has led to large inefficiencies in screening with too many false positive findings and delayed diagnoses of lung cancer. Because of this, some organizations have expressed concern about being able to properly perform lung screening, including large healthcare organizations such as the United States Veterans Association.

This project involved the development of a teaching file of cases to demonstrate the various types of abnormalities that can be found on lung CT scans. These were chosen from the large database of cases at the Mount Sinai Medical Center. Each case demonstrates different aspects of how the management algorithm works and includes a description of the findings in addition to what the recommendation should be for that finding. The recommendations for both Lung-RADS and for I-ELCAP were developed using the same set of cases to allow for demonstrating differences between the protocols. This database will be made available as an online resource for

anyone interested in learning about screening. It will be an ongoing program since recommendations are often updated. The initial database will include approximately 100 cases which will be representative of the most common findings.

In addition, a subset of cases will be used as a testing set. The cases chosen for this will also be representative of the common findings, but in this set the user will be asked to describe how the findings will be managed by use of multiple choice questions. The system for monitoring this is now in the process of being developed and will provide feedback to users in terms of how well they have learned to follow appropriate recommendations.

All of the cases chosen for use in the teaching file and testing data sets have been selected from a well-documented database of cases that have long term follow ups so the diagnoses are secure. Each of the images was then reviewed by a senior radiologist. The findings are identified on each of the scans and the images are placed on Powerpoint slides. Various displays for the slides are now being considered, and the software for managing the test sets and recording results is currently under development. It is expected that the teaching file will be available for use in the next 3 months and the testing database in 6 months.

The Anti-Inflammatory Prodrug Sulfasalazine Alters Gut Microbiome Function

Elana Apfelbaum[1,2], Reese Hitchings, and Libusha Kelly[2]

[1]Stern College for Women, Yeshiva University, New York, NY; [2]Department of Systems and Computational Biology, Albert Einstein College of Medicine, Bronx, NY

Short Chain Fatty Acids (SCFAs) are products of the fermentation of dietary fibers by the gut microbiota and are important in maintaining colon health. Monitoring the amounts of SCFAs produced can shed light on the way that the gut microbiota reacts to xenobiotics. Sulfasalazine (SSZ) is an anti-inflammatory prodrug used to treat ulcerative colitis and rheumatoid arthritis that relies on the gut microbiome for activation. Although Sulfasalazine's interaction with the gut is well established, the extent to which the drug alters the gut microbiome remains unclear. The production of SCFAs is a quantitative metric of microbial activity in response to SSZ exposure.

Sulfasalazine is a known antibiotic that interacts with the gut microbiome. Therefore, we hypothesized that over a 48-hour period, there would be fewer SCFAs produced in the samples that received SSZ than in the ones that lacked exposure to the drug. The production of SCFAs was tested in anaerobic fecal slurries in the presence and absence of SSZ. We observed a trend that suggests that the samples that were given SSZ produced fewer SCFAs than the samples that lacked SSZ. This decrease in SCFA demonstrates that microbiome function is altered in the presence of SSZ. The therapeutic function of SSZ relies on activation by colonic bacteria, and is highly variable between individuals. We investigated the role of individual cultures in the activation process. *Escherichia coli* is a member of the gut microbiome and a well-characterized organism to model interaction between individual microbes and SSZ. To measure the rate at which *E. coli* activates SSZ in vitro, we quantified SSZ loss over time with UV-Vis spectrophotometry. We observed that the *E. coli* samples preformed azo reduction and completely metabolized the drug within 54 hours.

Future research will continue to profile the effect of SSZ on SCFA production. We are currently analyzing the contribution of the two derivatives of SSZ to its inhibition of SCFA production and exploring the impact of SSZ on the growth of other isolated members of the gut microbiome, such as Bacillus subtilis. As we continue to test other samples, we hope to increase the sample size to gain a broader understanding of the alterations SSZ causes to the gut microbiome. These experiments bring us closer to building a profile of the gut microbiome's interaction with SSZ, and demonstrate the need for deeper analysis of how SSZ and other azo prodrugs influence microbiome function in individuals.

Molecular and cellular effects of new mutation in the CACNA1H gene in Autism Spectrum Disorder

Aline Budet Halpern[1], André Luiz Teles e Silva[2,3], Ana Karolyne Gomes[2], Juliana Corrêa[4], Talita Glaser[4], Karina Griesi-Oliveira[2], Alexander Henning Ulrich[4], Maria Rita Passos Bueno[3], and Dr. Andréa Laurato Sertié[2].

[1]Stern College for Women, Yeshiva University, New York, NY. [2]Department of Neuroscience at the Albert Einstein Israeli Education and Research Institute, Albert Einstein Hospital, Sao Paulo, Brazil. [3]Bioscience Institute, University of Sao Paulo. [4]Chemistry Institute, University of Sao Paulo.

Autism Spectrum Disorder (ASD) is a multifaceted and genetically heterogeneous disorder. However, recent advances in genetic and molecular science have opened up further paths and opportunities within genetic counseling and molecular genetic investigation. Currently, it is estimated that by using the available molecular tests, a prospective underlying genetic cause can be identified in nearly 25% of cases (Sertié, 2016).

ASD is a neurodevelopmental condition mainly portrayed by impairment of reciprocal social communication, and restricted, repetitive patterns of behavior. Once its genetic architecture is looked into more deeply, the disorder can generally be divided into three major groups. Monogenic disease, meaning that one strong unique mutation by itself can cause the disorder. This case is by far the most uncommon, which leaves the other two groups from which we can study and gain the most data points and understanding. Oligogenic factor needs two or more mutations, that, combined can cause the disorder. And polygenic or multifactorial is considered the most common, where there are genetic mutations as well as environmental factors. The high number of genomic alternatives brings a rather diverse group of phenotypes included in this vast spectrum.

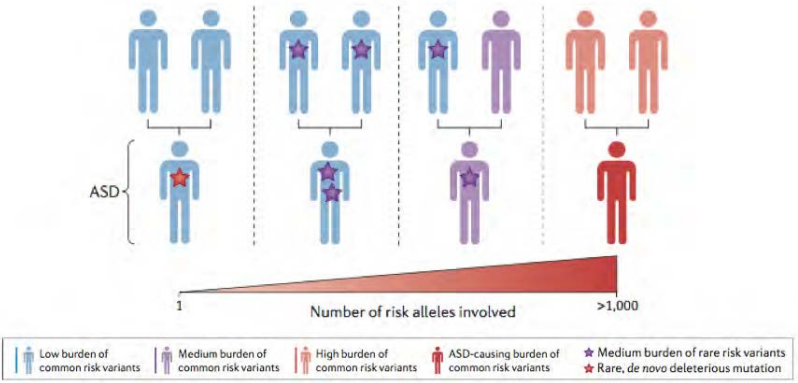

Figure 1: The transmission of ASD may occur through one of various paths. A *de novo* highly penetrant mutation can cause ASD even in individuals with a high genetic buffer for ASD (far left). ASD may also arise in children if both parents have a medium burden of rare variants (left-of-middle) or if one parent

has a medium load of common risk variants for ASD and one has medium burden of rare risk variants (right-of-middle). Finally, children might develop ASD if both parents have a high load of common risk variants (far right).

One known ASD gene candidate is *CANA1H*. Loss of function, due to mutations in this gene, have already been identified in ASD patients. However, what has not been clearly acknowledged is how this mutation contributes to the given disorder. This gene is responsible for the subunit α^1 of the Calcium (Ca^{2+}) canal, denominated Cav3.2, which is voltage dependent. This specific subunit forms a pore in the canal and modulates the conductance and voltage-dependent kinetics of the channel. Influx of extracellular Ca^{2+} regulates numerous cellular processes, such as gene transcription, neurotransmitter release, cell proliferation, migration, and the activity of intracellular signaling pathways, such as the PI3K-mTOR pathway.

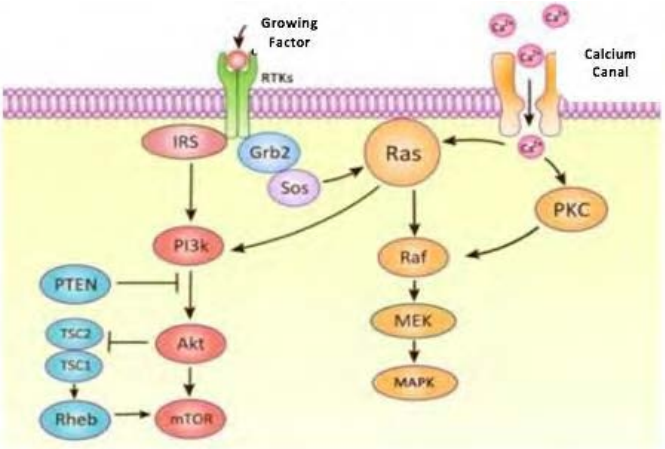

Figure 2: Possible correlation between Calcium influx and PI3K-mTOR pathway.

In this research, a complete exome sequencing was done in a group of ASD patients. In the patient called F2688 a point mutation in a 5' splice donor site of intron 13 of the *CACNA1H* gene, which is predicted to alter mRNA, leading to the inclusion of 52 amino acid residues in the channel pore region was revealed. Also, a hyper function was noted in the PI3K-mTOR intracellular signaling pathway in previous studies by the group. The research aims to verify if the *CACNA1H* gene mutation in this patient is functional, meaning if it is actively causing an abnormal influx of Ca2+ in the patient neural cells. It also seeks to discover if, in conjunction, this disturbance is altering the PI3K-mTOR pathway and its neural cell migration.

Induced pluripotent stem cells (IPSC) are taken from the patients' and control individuals' deciduous tooth and differentiated to neuroprogenitor cells (NPC). Those cells go through several procedures in culture so then it would be able to accomplish the genomic and protein analysis of *CACNA1H*, calcium influx, electrophysiology, PI3K-mTOR pathway activity and cell migration. To verify

that this specific gene (*CACNA1H*) is the unique cause of these molecular abnormalities listed, a molecular cloning is performed using HEK 293. This cell does not contain the genetic information of the patient and only the patient's mutated allele is placed while inserted in a plasmid. Then it is possible to substantiate if this specific gene mutation influencing in the phenotype.

Antifreeze Proteins Prevent Freezing Injury by Shaping Ice Crystals

Nechama Dembitzer and Ran Drori

Department of Chemistry and Biochemistry, Stern College for Women, Yeshiva University, New York, NY.

Background:

Antifreeze proteins (AFPs) and antifreeze glycoproteins (AFGPs) are the key to survival for fish, insects, plants and other organisms that endure subzero temperatures. This diverse group of proteins inhibits the growth of ice crystals and limits freezing injury. When ice grows in pure water a flat disc-like crystal is observed. In contrast, when AFPs are present, they adsorb to specific crystal planes and form a distinct ice crystal shape. The binding of AFPs to ice increases the ice surface curvature that develops between adsorbed AFPs, thus creating a gap between the melting and freezing points (thermal hysteresis, TH). The plane to which each AFP binds is one factor that determines the resulting ice crystal shape. Here, we study AFPs that adsorb exclusively to prism/pyramidal planes, which completely inhibit ice growth along the *a*-axis but allow step-by-step growth along the *c*-axis, resulting in a final bipyramidal crystal shape (see Figure 1). While it is known that each AFP has a characteristic adsorption rate, it is unknown how the adsorption rate affects ice growth inhibition and crystal shape. The competition between ice growth and AFP adsorption occurs with each step, and the difference in their rates determines the size of the new layer. We predict that as the AFPs adsorb more rapidly to the prism/pyramidal planes, the ensuing steps will be inhibited more quickly, resulting in less elongated crystals (see Figure 1). The parameter used to quantify the morphology of the crystal is the *c*-to-*a* ratio, which is obtained by dividing the length of the *c*-axis by the length of the *a*-axis. Therefore, our hypothesis is that an increase in the adsorption rate of the AFP will decrease the size of each new step, thus, fewer steps would be needed to form a sharp tip, resulting in a decrease in the *c*-to-*a* ratio.

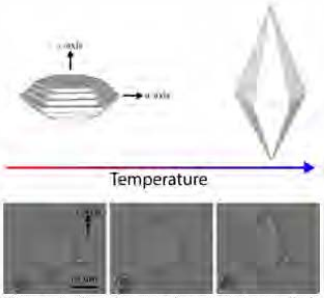

Figure 1. Step by step ice crystal growth in the presence of AFPs with bipyramidal shape achieved after cooling. The upper panel is a schematic depiction and the lower panel is the evolution of an ice crystal grown in the laboratory.

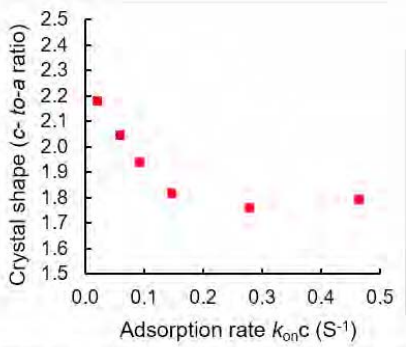

Figure 2. The effect of adsorption rates, k_{on}c, of AFP type III (isoform QAE) and $AFGP_{1-5}$ on *c*-to-*a* ratios of ice crystals. Each data point is an average of five crystals.

Experimental:
We used a custom-made nanoliter osmometer governed by a LabVIEW program. The nanoliter osmometer uses a temperature controlled cold stage to allow for precise adjustments in the temperature of the sample (±0.002 °C). After the sample is inserted into the device, the temperature is decreased until freezing occurs. Then, the temperature is slowly increased until a single crystal is obtained. To grow the crystal, a constant cooling rate was used to decrease the temperature in incremental steps. To calculate the *c*-to-*a* ratio, five bipyramidal crystals were obtained for each sample and their size was measured. The average *c*-to-*a* ratio for each sample was calculated and plotted against the adsorption rate. Adsorption rate is defined as the characteristic adsorption rate of each AFP, K_{on}, multiplied by the respective concentration used, C.

Results:
Values of *c*-to-*a* ratios were measured for two AFP type III isoforms, QAE and SP, and for $AFGP_{1-5}$ and $AFGP_{7-8}$. As a general trend, as the concentration increased, the *c*-to-*a* ratio decreased, leading to less elongated crystals. However, adsorption rates are only known for AFP type III (QAE isoform) and $AFGP_{1-5}$.[1] Therefore, we used a range of concentrations of AFP type III (QAE isoform) and $AFGP_{1-5}$ and their known respective K_{on} values to plot adsorption rate, K_{on}c, *vs.* measured *c*-to-*a* ratios (see Figure 2). The plot shows that the *c*-to-*a* ratio decreased as the adsorption rate increased until it plateaued at a ratio of 1.7. At this point, the *c*-to-*a* ratio may signify the lowest ratio that can be achieved by AFPs regardless of increase in adsorption rate.

Conclusion:
AFPs offer much promise in applications ranging from cryopreservation and cryosurgery to better food preservation and frost damage control in agriculture. However, to most efficiently apply AFPs, a better understanding of their effect on ice crystal shape is needed. In fact, this study is the first to relate AFP adsorption rate to ice crystal shape. Our results show that as adsorption rate increased, *c*-to-*a* ratios decreased until they reached a plateau. This unique study is the first to relate adsorption rate to ice crystal shape. Furthermore, a similar relationship between TH and *c*-to-*a* ratios may be deduced from our results based upon the linkage of TH and adsorption rate in previous studies.[1] Our findings agree with an earlier study by DeLuca *et. al,*[2] who demonstrated that as AFP type III concentrations decreased, *c*-to-*a* ratios increased. In light of our findings, this relationship can be attributed to the

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References:
1. Meister, K., DeVries, A. L., Bakker, H. J. & Drori, R. Antifreeze Glycoproteins Bind Irreversibly to Ice. *J. Am. Chem. Soc.* **140,** 9365–9368 (2018).

2. DeLuca, C. I., Chao, H., Sonnichsen, F. D., Sykes, B. D. & Davies, P. L. Effect of type III antifreeze protein dilution and mutation on the growth inhibition of ice. *Biophys J.* **71,** 2346–2355 (1996).

decrease in adsorption rate of the AFP as concentration decreased, which results in increased *c*-to-*a* ratios. These researchers also tested several AFP type III mutants and showed that *c*-to-*a* ratios increased as the mutation was more severe, and the activity of the protein was reduced. In the future we will determine the adsorption rates for the remaining AFPs. Additionally, we will test if the correlation present here is valid for those AFPs as well. Understanding the relationship between AFP activity and crystal shape is essential in employing AFPs for their many potential applications.

Anticarcinogenic and Anti-migratory Effects of Apple Extract on Human Squamous Oral Carcinoma Cells

Nechama Dembitzer, Chana Bushee, Yael Ghelman, Haley Kandelshein, Monica Marmer, and Alyssa G. Schuck

Stern College for Women, Yeshiva University, New York, NY

With over 450,000 cases per year diagnosed worldwide, oral carcinoma is the most common form of head and neck cancer, with a high rate of relapse and poor long-term prognosis. Beneficial lifestyle factors that preventive or therapeutic are an important focus of current research. In particular, nutraceuticals, the non-nutritive components of fruits and vegetables, have been shown to have anticarcinogenic effects, among their other health benefits. Previous studies in this laboratory on an apple extract (AE) from the species *Malus pumila mill* demonstrated the anticarcinogenic property and selective cytotoxicity of AE toward human oral carcinoma HSC-2 cells, compared to normal gingival HF-1 and GN46 fibroblasts. HSC-2 cells were significantly more sensitive to AE treatment than were the normal fibroblast cells. Moreover, the cytotoxic effects of AE were not attributed to induction of oxidative stress within the cancer cells; rather, the polyphenolic components of the extract *per se*, rather than their autooxidation products, induced apoptotic cell death in HSC-2 cells.

In order to further elucidate the effects of AE on HSC-2 oral carcinoma cells, specifically its inhibition of cell migration, a wound healing assay was conducted. HSC-2 and HF-1 cell monolayers were "wounded" by scratching the monolayer, followed by incubation of the cells either in unamended media, or media containing AE, for 24 hr.

Figure 1. Closure of wound in HF-1 monolayer. HF-1 cells were seeded in 12-well plates in complete DMEM media and grown to 80-90% confluency in a monolayer overnight. After 24 hr, a wound/scratch was created along the diameter of each well using a 200 µl pipette tip (a). Cell debris were removed, followed by addition of fresh media alone (b) or containing (c) 25, (d) 50, or (not shown) 75 µg/mL AE

Figure 2. Closure of wound in HSC-2 monolayer. HSC-2 cells were seeded in 12-well plates in complete DMEM media and grown to 80-90% confluency in a monolayer overnight. After 24 hr, a wound/scratch was created along the diameter of each well using a 200 µl pipette tip (a). Cell debris were removed, followed by addition of fresh media alone (b) or containing (c) 25, (d) 50, or (not shown) 75 µg/mL AE.

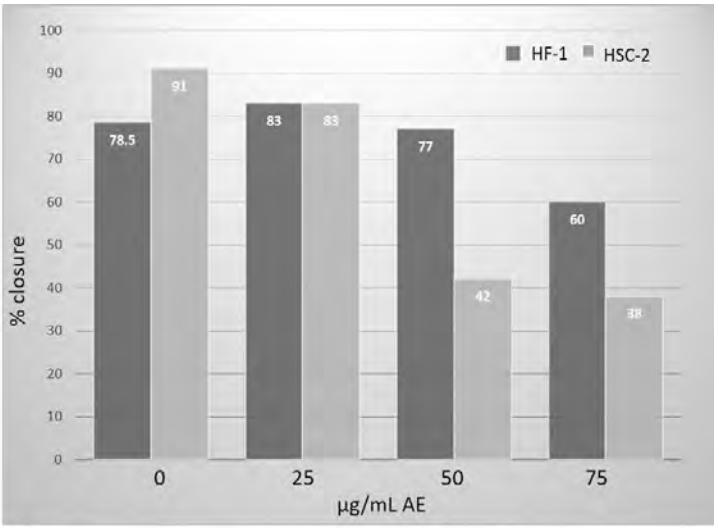


Figure 3. Wound healing was measured 24 h after scratch and treatment by phase contrast microscopy using an ocular micrometer. The distance across the scratch was measured at three different areas along the wound. Mean values are shown.

The wound size decreased in both HSC-2 cells and HF-1 cells after 24 hr incubation in fresh, unamended media. However, HF-1 cells displayed a 35% and 22% higher wound closure at 50 and 75 µg/mL AE, respectively, suggesting the selective inhibition of carcinoma cell migration and/or proliferation. Our results demonstrated the inhibition of wound healing by AE in HSC-2 carcinoma cells, and to a significantly lesser degree in normal HF-1 fibroblasts. Further studies aimed at distinguishing between cell proliferation and cell migration using mitomycin C remained inconclusive.

Computational Methods in Kirby Calculus

Yael Eisenberg[1,2], Laura Stordy[2], Matthew Uffenheimer[2], and Julian Chaidez[2]

[1]Stern College for Women, Yeshiva University; [2]University of California, Berkeley

Kirby Calculus gives us the tools to analyze 4-dimensional manifolds based off of their handlebody decomposition. We can play around with the manifolds by generating Kirby diagrams, and performing Reidemeister moves, handle annihilations, and handle slides to adjust the diagram. If we begin with a Kirby diagram and perform a sequence of 'Kirby moves,' the new manifold is mathematically equivalent to the original one. We created a python package called MetaKnight (Manifolds Encoded Through the Architecture of Knots and Numbers In the Geometry of Handlebody Theory), which performs all types of Kirby moves on Kirby diagrams. The user inputs the planar diagram, including the 1-handles, 2-handles, framing coefficient (amount of twists), crossings, and joins, and can manipulate the diagram using the Kirby moves described below.

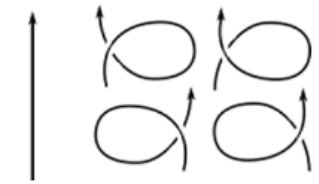


Figure 1: The four cases of a Reidemeister 1

Reidemeister 1 takes a strand and twists it. There are four ways the strand can be twisted, and the user takes this into account by inputting the orientation (clockwise vs counterclockwise), and if the incoming strand should be over or under.

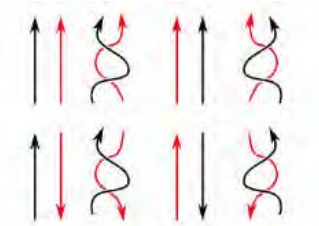


Figure 2: The four cases of a Reidemeister 2

Reidemeister 2 pokes one strand on top of another. Similarly to Reidemeister 1, there are four ways to perform a Reidemeister 2 and the input includes which strand is on the left, which strand gets poked 'over', and if the strands are facing in the same direction.

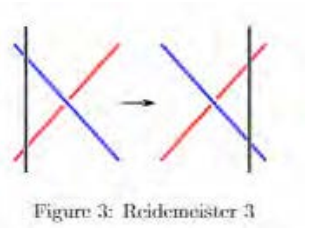
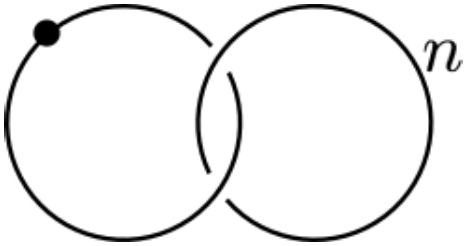


Figure 3: Reidemeister 3

Reidemeister 3 takes three strands as inputs (the triangle), where one is over the other two and another is under the other two. The 'over' strand is slid over the crossing to the other side. This is equivalent to pushing the 'under' or 'middle' crossing over the opposite crossing. There are eight (2^3) 'options' for Reidemeister 3, as each of the 3 strands have an option of 2 orientations. Performing and reversing a Reidemeister 3 are equivalent.



Handle annihilation: A 1-handle (left) and unknot of any framing (right) can be added or removed to any Kirby diagram without changing the manifold. Handle annihilation takes in a strand from the handle(s) to be cancelled, checks if a cancellation is possible, and then removes all crossings, joins, and strands from the Kirby diagram.

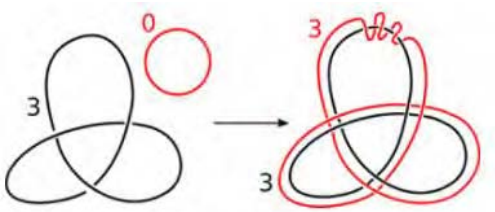


Figure 4: Handle slide

Handle slides: A handle slide quite literally slides one handle over the other, in the figure above the red handle is slid over the black handle. This is done by making a parallel copy to the right of all the strands in A, adjusting crossings (each crossing in A turns into four crossings), and attaching the parallel copy of A onto B. If A has blackboard framing f, we add f clockwise/counterclockwise (depending on sign) twists to B about A. The framing of B is updated as well. Handle slides can either be handle addition (where the parallel copy of A is oriented the same as A), or handle subtraction (where A and its parallel copy have opposite orientations).

To access the MetaKnight Python package:
https://github.com/mattuff/metaknight

Kirby Calculus textbook: Gomph, R. E., & Stipsicz, A. (1999). 4-manifolds and Kirby Calculus. Providence, RI: American Mathematical Society.

Using D3 JavaScript Visualizations to Display the Intersecting Categorizations of the Sefer HaChinukh's Count of the 613 *Mitzvot*.

Sarah Engel[1] and Russel Neiss[2]

[1]Department of Computer Science, Stern College for Women, Yeshiva University, New York NY;[2] Sefaria, St. Louis MO

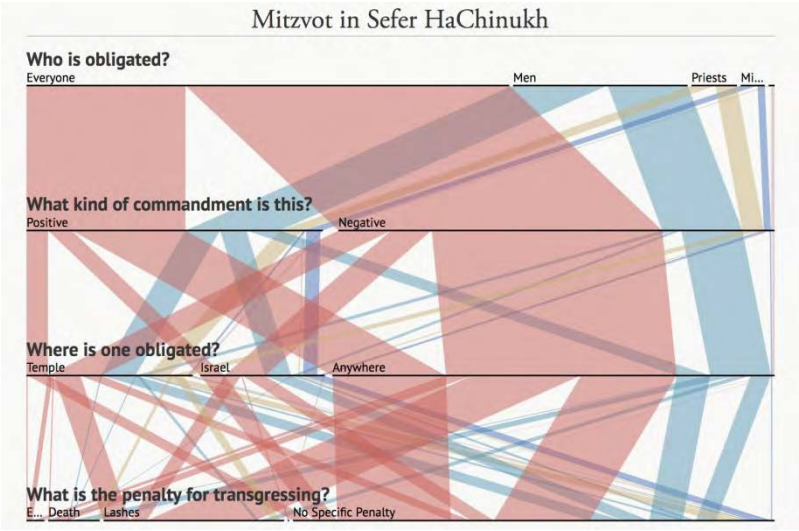
Digital Humanities is a growing field at the intersection of the humanities and computer science which strives to apply computational tools to the interpretation of literature and other texts. This project aimed to use data based on Sefaria's extensive digitized library of Jewish texts to create a visualization that is both informative and beautiful, processing Jewish text using computational strategies. We wanted to use the intertextual links between the 13th century codification of Jewish law, the Sefer HaChinukh, and Maimonides' 12th century Mishneh Torah as well as their categorizations amongst the different types of *mitzvot* (Jewish commandments) to create a data set that could be interpreted by an open source d3 JavaScript visualization file, that would represent our data set in an esthetically pleasing and visually informative way.

In order to create this data set, we had to determine which categorization labels for the various *mitzvot* to focus on, based on how the Sefer HaChinukh delineates distinctions in applicability. We chose to categorize *mitzvot* based on who is obligated, where this commandment takes effect, whether it was a positive (active) or negative (passive) commandment, as well as the penalty for transgression. Then, we created a Python script which used regular expressions to parse through the text of the Sefer HaChinukh itself, creating a CSV (a file with comma separated values) which listed each commandment, and appended the appropriate labels of "time", "people", "penalty" and "type" for each commandment. This process was complicated by two unexpected challenges. First of all, the Sefer HaChinukh does not explicitly delineate the *mitzvah*'s "type" (positive or negative) in the body of his text, so every commandment was cross-checked using the Sefaria intertextual links against Maimonides' Mishneh Torah, another Jewish legal text which does explicitly categorize *mitzvot* according to type. Secondly, we had to account for the natural variances in human language, and the fact that the Sefer HaChinukh does not use the exact same phraseology each time he categorizes a commandment. We accounted for this computationally, by searching the text for common variances and then asking our script to account for those variances, but then had to manually fill in the rest due to the inevitable ambiguities of the human language computers struggle to understand. After completing the data set in CSV form, we built an HTML page and applied the open source d3 JavaScript visualization model to our data, which then processed our data set and converted it for display in a beautiful, interactive way.

The resulting JavaScript visualization allows the user to view the intersecting categorization of the various *mitzvot* on a macroscopic level, giving the user a

sense of breadth in understanding how the Sefer HaChinukh organized the canon of Jewish law. Additionally, some interesting findings include the fact that when one applies the filters by gender, the vast majority of the *mitzvot* obligate both men and women, leaving only a small minority obligating only men. Obviously, if one wanted to engage in a deep study of Jewish law, this visualization would not suffice, and one would have to engage with the texts directly to understand the nuances in the language that the Python script we built may not have been as sensitive to, but having this tool will hopefully help students of Jewish texts across the world visualize the entire canon of the *mitzvot* and their intersecting sub-categorizations more visually accessible.

To see the visualization's interactive features, visit:
https://www.sefaria.org/visualize/sefer-hachinukh-mitzvot



Linguistic Analyses of Narratives and Children's Pre-Literacy Skills

Nurit Esral[1], Moreet Levine[1], Anna Schuman[1], Sharon Armon-Lotem[2], and Carmit Altman[3]

[1]Stern College for Women, Yeshiva University, New York, NY; [2]Department of English Literature and Linguistics, Bar-Ilan University's Leslie and Susan Gonda (Goldschmied) Multidisciplinary Brain Research Center, Ramat Gan, Israel; [3]Churgin School of Education, Bar Ilan University, Ramat Gan, Israel

Language, the building block of communication, can be affected by socio-cultural influences, developmental disorders, and acquired conditions. Clinicians use various methods to evaluate speech in order to determine if their clients have language difficulties. This research conducted in the linguistically diverse population of Israel and in the US focuses on various testing methods that are used to assess different aspects of language.

In the first study, clinical language assessments collected over the past 15 years in Israel from English-Hebrew bilingual preschool children were examined to study whether socio-cultural differences among religious bilingual Israelis affect their CELF (Clinical Evaluation of Language Fundamentals) test results. The CELF test is a pre-literacy test designed for English-speaking Americans. It assesses children's language and communication skills and tests their receptive and expressive language abilities. Since the test is based on American cultural norms it does not account for socio-cultural differences and does not guarantee an accurate description of Israeli children's pre-literacy skills. For example, in one section of the test, the child is shown a picture of a trophy and has to name the item. In the data that was analyzed from the bilingual English-Hebrew speaking participants, many referred to the picture of a trophy as a "gvi'a", which is a goblet in Hebrew. This is an item that is used in many religious homes on the Sabbath and is therefore more culturally familiar to many religious bilingual Israeli children than a trophy. Due to this cultural discrepancy, children who are unfamiliar with the word "trophy" will receive a zero on that test item, but that is not indicative of their pre-literacy abilities. It is therefore crucial for clinicians to be cognizant of socio-cultural influences that can manifest themselves in certain test items and to be cautious not to diagnose a bilingual child exclusively based on test scores.

In the second study, data was analyzed for a pilot project on Narrative Response to Intervention (NRTI) among children with and without a Developmental Language Disorder (DLD). The goal of this study is to see whether NRTI positively impacts the complexity of children's narratives. Their story-telling abilities were monitored at four different times throughout intervention. At each of the four monitoring sessions the children used pictures to retell a different story that the interviewer delivered. Hundreds of recordings were transcribed into the CLAN computer program using CHAT (Codes for Human Analysis of Transcripts) conventions. The narratives were then analyzed using a multi-faceted coding system encompassing the macro (story

grammar elements) and micro (Mental State Terms and language complexity) structure of the children's narratives. Growth in the macro and micro structure of each participant's narrative can indicate the effectiveness of the treatment.

For the final study, narratives from American adults with and without aphasia were divided into utterances and coded for various elements of language complexity such as grammar, and local and global coherence. Once they are all coded, the results will be analyzed and compared to determine if the disfluencies are typical discourse errors or are qualities of aphasic speech. For instance, several self-corrections within a narrative may or may not be a symptom of aphasic speech. These studies, that are still ongoing, are important to clinicians in their evaluations and diagnoses of individuals with language difficulties. Accurate diagnostic testing and treatment is crucial to the wellbeing of each individual.

Manganese-Induced Neurotoxicity: *C. elegans* as a Model to Study Parkinsonism and other RAGE-Related Neurodegenerative Pathologies

Bailey Frohlich[1,2], Adi Pinkas[2], Kun He Lee[2], and Michael Aschner[2,3]

[1]Stern College for Women, Yeshiva University [2]Department of Molecular Pharmacology, Albert Einstein College of Medicine, [3]Department of Neuroscience, Albert Einstein College of Medicine

Advanced glycation end products (AGE) are non-enzymatically glycated proteins whose accumulation in the body, either by consumption or endogenous formation through Maillard's reaction, is linked to oxidative stress and inflammation. AGE and its multi-ligand receptors RAGE, are implicated in a wide range of pathologies such as cardiovascular diseases, nephropathy, and diabetes, and is notably associated with the neurodegeneration involved in Alzheimer's disease (AD), Parkinson's disease (PD), Huntington's disease (HD), amyotrophic lateral sclerosis (ALS) and other neuropathies. RAGE activation is considered a major mediator in AGE pathogenicity, and thus RAGE expression can be targeted as both an indicator and a therapeutic tool in understanding AGE-related diseases. Previous studies have focused on the role of toxic chemical elements such as metals in neurodegeneration, RAGE activation, and the onset and exacerbation of RAGE-related behavioral impairments and pathologies. This project focuses on Manganese (Mn), an essential heavy metal whose nutritional and metabolic function is paralleled by it role as a neurotoxicant upon chronic exposure via occupational, environmental or nutritional sources. Mn exposure is a significant non-genetic risk factor for PD and is implicated in a disease called manganism, resulting in extrapyramidal motor disorders.

Caennohabditis elegans is a highly advantageous nematode model for studying PD and other neurodegenerative disorders due to its anatomical simplicity (302 nerve system cells), translucent body, small size, short 20-day lifespan, rapid development (~3 days/generation), affordability and ease of maintenance, higher evolutionary conservation (sharing ~40% of disease-related genes with humans), and conserved neurotransmitter system. A transgenic RAGE-expressing *C. Elegans* model has been created in order to specifically study RAGE-related pathologies and can be used to study mechanisms of Mn neurotoxicity. Using this model, we can investigate the effects of Mn exposure on RAGE expression to test the hypothesis that the RAGE worms will be more susceptible to Mn exposure as they are already compromised due to RAGE-related oxidative stress and inflammation.

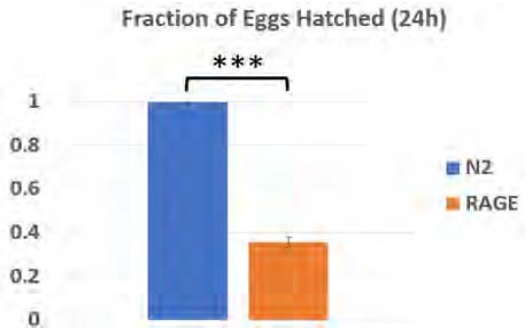


Figure 1

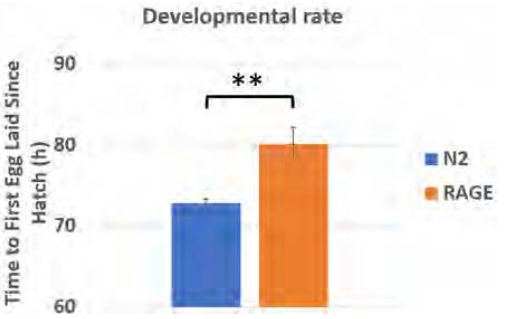


Figure 2

Preliminary studies showed that the RAGE-expressing worm is morphologically and developmentally impaired compared to their N2 wild type counterparts **(Figures 1 and 2)**. Locomotion (number of body bends per minute), developmental speed, egg viability and neuronal morphology were assessed, indicating that the RAGE worm produces viable offspring at a significantly lower rate than their N2 counterparts and also express a lower dopaminergic signaling, measured by florescent signal intensity.
To establish a relevant dose exposure for RAGE as compared to N2, we conducted lethality assays to determine the LD_{50} concentration. Worms were treated at the L1 stage with eight concentrations of Mn solution ranging from 0-100mM in 85 mM NaCl and plated in triplicate on NGM OP50 seeded plates with 30-50 nematodes per plate. After 48 hours of exposure, the survival rate of worms was calculated and a lethality curve was generated through Prism. The LD_{50} established for the N2 worms was 52.46 mM **(Figure 3)**. However, the curve for the RAGE worms remains inconclusive due to their aforementioned developmental impairments, such that only 36% of eggs hatch at a slower rate than N2 and their lifespan differs from that of N2. Thus for the project to progress, more baseline studies on RAGE-expressing worms must be conducted to develop a proper modified exposure protocol.

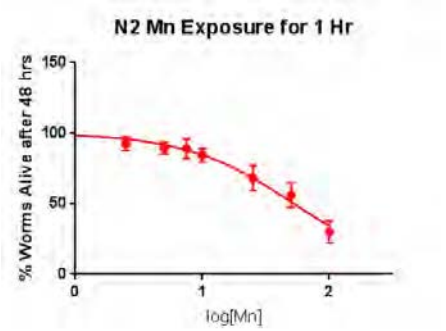
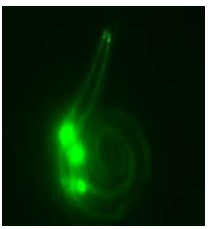


Figure 3



RAGE x DA, 0M 6OHDA RAGE x DA, 5M 6OHDA

Figure 4

Upon establishing an LD_{50}, we expect Mn to have differential effects on RAGE and N2, indicating a discrepancy in how metal intoxication effects RAGE expression in neurons. We conducted preliminary neurodegeneration assays on RAGE to examine the neuronal morphology as it differs from N2 worms, in which RAGE presented with dendrite bleb formation when neurodegeneration was induced by a known toxicant, 6OHDA **(Figure 4)**. Future studies should include neurotransmitter-specific behavioral assays, specifically targeting the dopaminergic system as RAGE has been implicated in previous studies as a mediator in dopaminergic neurodegeneration in a PD context. Future studies should also analyze the role of known molecules in the RAGE-inflammation pathway and the impact of heavy metals on their expression. Overall, the RAGE *C. Elegans* strain can prove as a valuable model for studies in neurodegenerative pathologies and effective therapeutic strategies.

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Cellular Senescence Markers are Altered in Rat Soleus Muscle Paralyzed by Contusion Spinal Cord Injury

Abigail Goldberger[1], Zachary A. Graham[2, 3], William A. Bauman[2, 3], Joshua F. Yarrow[4, 5], and Christopher Cardozo[2, 3]

[1]Stern College for Women, Yeshiva University, New York, NY, USA; [2]National Center for the Medical Consequences of SCI, James J. Peters VA Medical Center, Bronx, NY, USA; [3]Icahn School of Medicine at Mount Sinai, New York, NY, USA; [4]Research Service, Malcolm Randall VA Medical Center, Gainesville, FL, USA; [5]Division of Endocrinology, Diabetes, and Metabolism, University of Florida College of Medicine, Gainesville, FL, USA

Considered by some to be a model of accelerated aging, spinal cord injury (SCI) affects approximately 282,000 people in the United States with 17,000 new cases arising yearly. SCI results in several secondary consequences that lead to long-term physiological degeneration, including, but not limited to, muscle atrophy and poor muscle performance. The injury profile is remarkably diverse and depends on the level, severity, and cause of the SCI. Cellular senescence, a programmed withdrawal from the mitotic cycle to a viable but non-proliferative state, may contribute to age-related decline and may play a role in local and systemic pathologies frequently exhibited by those with SCI.

Cellular senescence is primarily a tumor-suppressive mechanism, encouraging tissue regeneration by reducing the burden of outdated and/or damaged cells. A senescent cell demonstrates a senescence-associated secretory phenotype (SASP) that promotes immune clearance of the senescent unit but may also involve the release of other potentially harmful molecules that can impair surrounding cells or elicit their 'secondary' senescence via paracrine regulation. Excessive cellular senescence contributes to various pathologies and is thought to be a critical component of sarcopenia, the involuntary loss of muscle mass observed with aging [1]. If chronically paralyzed skeletal muscle is shown to display elevated markers of senescence, it could become a viable target for evolving senotherapeutic approaches.

No study has reported the effect of muscle paralyzed by SCI on senescence markers. This pilot study therefore examined protein and gene expression of key senescence markers in paralyzed muscle from 4-month old (adult) male rats at sequential timepoints after moderate-severe contusion SCI at thoracic-level 9 (T9). The left soleus muscle was obtained from rats at 2 weeks, 1 month, 2 months, and 3 months post-SCI. Six animals were randomly selected from each group. SCI animals were matched against sham controls (animals that received T9 laminectomy but no spinal cord manipulation) at each timepoint. Muscles were homogenized and prepared for Western immunoblotting and/or mRNA analysis. Proteins of interest were p53, p27, and p16, main regulators of cellular senescence. Target genes were IL-6, IL-1β, and TNFα, senescence and atrophy-related proinflammatory cytokines.

Total p53 protein levels were demonstrated to be elevated in SCI samples at the 2-week ($p<0.05$), 1-month ($p<0.05$), and 2-month ($p<0.05$) timepoints. p27, a cell cycle inhibitor elicited as a result of the SASP, was moderately but not statistically elevated at the 2-month and 3-month timepoints. Conversely, p16, another cell cycle inhibitor commonly associated with senescence, trended to be lower at 2 months and had a significant decline at 3 months ($p<0.05$). At the 1-month timepoint, IL-6 and IL-1β gene expression exhibited mean trend elevations ($p=0.12$, $p=0.11$ respectively), and TNFα was statistically elevated ($p<0.05$). At 2 months, IL-1β expression was significantly reduced ($p<0.05$) while IL-6 and TNFα did not display any notable trends.

As a prolific apoptotic marker involved in multiple cell signaling pathways, p53 is not exclusively linked to cellular senescence, but it is a crucial upstream regulator of many of the senescence pathways. There is also evidence to suggest that senescence and apoptosis may be linked, since the inhibition of either process during embryonic development triggers comparable compensatory responses [1]. The upward trend of p27 would be consistent with the possibility of cellular senescence as well, but p16's decline does necessitate further consideration and inquiry. Studies have indicated that p53 deficiency is connected to p16 upregulation and that restoring normal p53 levels can reduce p16 to its original state [2]. The relationship between p53 and p16 in our data is unclear, though one possible explanation may be a time-dependent shift in regulators of different cellular senescence pathways, several of which were not investigated in this preliminary work. Of note, the elevation in TNFα and upward trends in IL-6 and IL-1β at 1 month are consistent with the general SASP profile. Regardless, the variability of the cytokine data, particularly at the 2-month timepoint, does require additional investigation. Potential interactions between these senescence regulators and cytokine expressions should be analyzed using conditional protein knockdowns in SCI mouse models.

Even in highly controlled settings, contusion SCI models may result in wide variation among animals due to the nature of the injury and the individual responses. While the variability of the data does present a limitation to our interpretation, the data suggests that SCI might be associated with markers of cellular senescence. Future research may aim to elucidate the nature of these connections to be able to consider effective novel therapies for those with SCI.

We would like to acknowledge VA RR&D grants RX001273-0 and B9280O to JFY and B2020C to WAB for funding these studies. The work represented herein does not represent the views of the US Department of Veterans Affairs or the US Government.

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Polycomb Mechanism Decouples Mutational from Environmental Robustness and May Contribute to Development of Metastatic Cancers

Sarah Graff[1], Maryl Lambros[2], and Aviv Bergman[2]

[1]Stern College for Women, Yeshiva University, New York, NY; [2]Department of Systems and Computational Biology, Albert Einstein College of Medicine, Bronx, NY

Understanding robustness is essential to understanding the evolution of complexity in organisms, such as the evolution of multicellularity or metastatic cancers. Robustness is a property of biological systems that ensures phenotypic insensitivity to mutational and environmental variance. Previous studies using gene network models have shown that mutational and environmental robustness are positively correlated with each other, and that they will evolve in tandem under stabilizing selection.

However, this evolution of environmental robustness is an obstacle to evolving multicellularity, where differentiating cells must be able to respond to internal environmental cues during development. Past research performed by the Bergman lab demonstrates epigenetic mechanisms, such as the Polycomb Group (PcG) proteins, being responsible for the decoupling of mutational and environmental robustness during cell differentiation n a developing multicellular organism. PcG proteins are a type of epigenetic regulation mechanism that are responsible for turning off specific sets of its target genes that are not being expressed over a critical threshold during early development. The Polycomb mechanism allows for multiple possible phenotypic outcomes, without changing the underlying genotype, based on the environment during development. This functionality has contributed to the theory that PcG proteins assisted in the transition from unicellularity to multicellularity.

To study the evolution of PcG protein activity, a computational gene regulatory network model was expanded by the Bergman lab to include the PcG mechanism. The model operates on two levels: population dynamics and gene regulatory networks (the genotype-phenotype mapping). The genotype of each individual in the population is represented by a gene regulatory of network of N genes. The gene expression dynamics are introduced by an input vector, $S(0)$, creating a steady state $\hat{S}$ of length N which defines the phenotype. If this steady state is not reached, fitness of the individual is zero. The individual also has a gene interaction matrix, W, of size N^2. W_{ij} is the effect of gene j on the product of gene i. $\hat{S}_w^t$ is the gene expression pattern of the individual at time t. At the population dynamics level, individuals go through iterations of mutation, reproduction, and selection. Mutational robustness is measured by randomly mutating an element in the W matrix and comparing the effect on phenotype $\hat{S}$ versus the $\hat{S}$ of the unmutated matrix. Environmental robustness is measured by introducing random changes into $S(0)$ and similarly comparing the effect on $\hat{S}$. It is assumed that Polycomb

begins to be expressed at t_c (time critical) during development. Informally, each gene *i*'s susceptibility to Polycomb is determined by $\theta_i \in \{0,1\}$, meaning that from t_c, gene expression is repressed if $\theta_i = 1$ and the expression level falls below a specific threshold level. This particular behavior is modeled after the known function of the Polycomb Repression Complex 1 (*PRC1*) in the *Drosophila* embryo where the Hox genes are permanently repressed by PRC1.

Currently, the aim is to recreate the previous results of this model. The future aim is to use this model to study changes in environmental robustness when the PcG proteins are disrupted, as seen in many metastatic cancers. Specifically, metastatic cancer cells seem to have the ability to directly switch their phenotype as a result of changes in their environment, even though these cells were already committed to a phenotype, i.e. differentiated. The Bergman lab proposes that this phenotypic pliancy is caused by a disruption of a mechanism conferring environmental robustness. The Polycomb mechanism is one such mechanism that confers a differentiated cell robustness to environmental perturbations. To study this, the Bergman lab uses the computational gene regulatory network model described above to model the disruption of the PcG mechanism on different cell types after evolution, and the behavior of the cell's environment robustness will be investigated by changing the environment and measuring phenotypic pliancy. We hypothesize that phenotypic pliancy results from decreased environmental robustness, which is caused by a disruption of the PcG proteins function. This makes the cells hypersensitive to their microenvironment and could allow metastasis to occur.

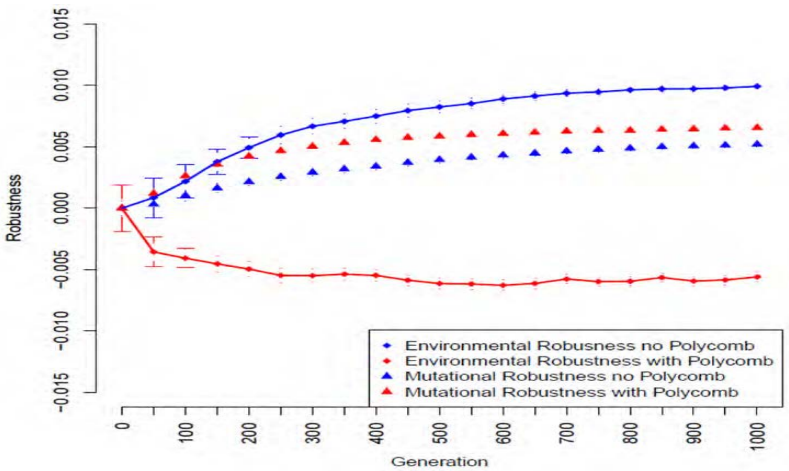

Figure 1. A gene regulatory network evolving under stabilizing selection without Polycomb, both mutational and environmental robustness increase together over time (blue). With Polycomb the system shows reduced environmental robustness while development of mutational robustness continues (red). All data shown are averages over 200 independent trials using a randomly selected founder individual; error bars represent the SEM.

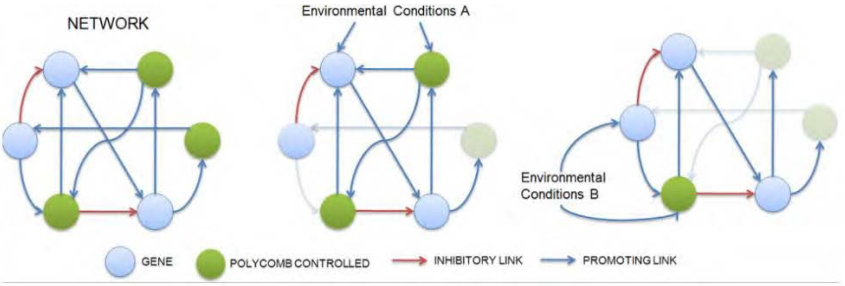

Figure 2. The Polycomb mechanism allows cells to have drastically different phenotypes even though the genotype is identical. Activation of Polycomb during development forces Polycomb-susceptible genes with low levels of expression to be permanently repressed, via chromatin modification, effectively trimming the network (faded interactions).

Analyzing the Twitter Follow Graph to Determine if it is a Social Network or Information Network

Avital (Tali) Greenberg[1] and Liam Roditty[2]

[1]Stern College for Women, Yeshiva University, New York, NY; [2]Department of Computer Science, Bar Ilan University, Ramat Gan, Israel

Twitter as a media platform continuously begs the question: is it a social network or an informational network? The standard Twitter follow relationship is primarily about consuming information, but still many follows are built on social ties. By characterizing the topological features of the Twitter follow graph and comparing them to available data from other social networks, we can argue that it is indeed a hybrid network.

Social networks and informational networks have different trends in specific properties of their follow graphs that allows for proper characterization. My research included analyzing properties of the Twitter graph such as degree distributions, connected components, shortest path lengths, clustering coefficients, two-hop neighborhoods, and degree assortativity using a Python module called Networkx. A social network's goal is towards sharing personal and professional experiences with a user's friends. Therefore, a social network's follow graph tends to exhibit properties such as high degree assortativity, small shortest path lengths, large connected components, high clustering coefficients, and a high degree of reciprocity. An informational network's goal is towards the dissemination of information and the dominant interaction is following those who provide information users want. Its follow graph tends to exhibit properties such as large vertex degrees, lack of reciprocity, and large two-hop neighborhoods.

My analysis found that the Twitter follow graph has some attributes consistent with social networks and other characteristics consistent with information networks. The average discrepancy between in degree and out degree of each vertex, representing the number of followers and friends a user has respectively, implies that Twitter is not a social network since it is highly unlikely that users can maintain the amount of social relationships as the number of outbound edges suggest. Additionally, the largest strongly connected component of the graph only contains 84% of all vertices in the graph. This is less than a standard social network; it implies that many edges in the graph are not reciprocated, meaning that users only follow other users for information dissemination or consumption and not to maintain social relationships. On the other hand, the average shortest path length of the graph is shorter than that of Facebook and tends to decrease with size, suggesting that Twitter does behave like a social network. Similarly, I have found that the average clustering coefficient amongst vertices with different degrees is consistent with expectations of a social network.

The results of analyzing these topological characteristics of the Twitter follow graph present that Twitter behaves like a social network in some ways and an

informational network in other ways. This hybrid network characterization implies that Twitter users have different motivations for using the platform. Twitter users can utilize Twitter to absorb and circulate information and ideas, as well as connect with friends and establish communities.

The results from my research were based off a Twitter dataset from the Stanford Network Analysis Project that contained a portion of the Twitter graph using data crawled from public sources. The next step in my project was to run this analysis on a more recent model of the Twitter follow graph. I connected to the Twitter API and used a Python module called Tweepy to harvest real Twitter users and wrote custom code to create a small sample of an updated Twitter graph. The continuation of this project would be to analyze the characteristics of this graph to identify if the structure of the Twitter follow graph has changed over time.

This research was adapted from research done by Myers, Seth A, et al. "Information Network or Social Network?: The Structure of the Twitter Follow Graph." ACM, Proceedings of the 23rd International Conference on World Wide Web, 2014, pp. 493–498.

Novel Treatment for Bronchoconstrictive Diseases: Relaxation of Airway Smooth Muscle by Gelsolin Peptide

Shani Kahan[1], Jose Perez-Zoghbi[2], Charles W. Emala[2], and Maya Mikami[2]

[1]Stern College for Women, Yeshiva University, New York, NY; [2]Department of Anesthesiology, Columbia University College of Physicians and Surgeons, New York, NY

Asthma, a chronic respiratory condition with bronchoconstriction, affects approximately 300 million people worldwide (1). Current asthma treatments, such as β-agonists and steroids, do not suffice in controlling approximately 50% of asthma patients (2). Patients with uncontrolled asthma are at a high risk of exacerbations, hospitalization and even death. Therefore, there is an unfulfilled clinical need for enhanced therapies for bronchoconstriction in patients that have been undergoing conventional asthma treatments. In this project, a novel mechanism was explored to treat bronchoconstriction. This approach involves modifying airway smooth muscle (ASM) constriction utilizing short phosphatidylinositol 4, 5 bisphosphate (PIP_2) binding peptide of Gelsolin.

Release of stored intracellular calcium stimulates many critical cellular processes such as ASM constriction (https://www.ncbi.nlm.nih.gov/pubmed/20626318). Upon binding to G protein coupled receptor, well-known Gq-coupled agonists such as acetylcholine or methacholine (MCh) leads to activation of phospholipase Cβ (PLCβ) causing hydrolysis of PIP_2. The PIP_2 binding region of gelsolin peptide prevents hydrolysis of PIP_2 to inositol triphosphate (IP_3) and diacylglycerol, which results in the prevention of calcium release from intracellular storage. We therefore hypothesized that the gelsolin peptide could modulate ASM calcium signaling and contraction.

We tested our hypothesis using mouse precision-cut lung slices. The 10 amino acid sequence of the gelsolin peptide (QRLFQVKGRR) within the PIP_2 binding domain was synthesized and conjugated with rhodamine B by Biomatik (Wilmington, DE). Peripheral lung luminal airway diameter change to various constrictive agonists and effect of the gelsolin peptide were observed using phase-contrast microscopy. Images were acquired using a CCD camera, and Video Savant software was used for the observation and analysis of ASM constriction and relaxation.

Gelsolin peptide caused significant ASM relaxation to pre-existing Gq-coupled agonist MCh-induced constriction, in models representing treatment for clinical asthma attack. Gelsolin peptide pretreatment also attenuated subsequent MCh-induced constriction, suggesting the peptide can be used to prevent asthma attack. Furthermore, when treated with caffeine and ryanodine, to deplete the intracellular calcium stores targeted by IP_3, the relaxation effect of the gelsolin peptide was no longer observed.

In conclusion, the project findings support the hypotheses that gelsolin peptide attenuates ASM constriction and that the relaxing effect of the peptide is due to its PIP_2 binding.

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Using a Computational Model of Co-transcriptional Splicing to Understand Alternative Splicing Outcomes

Ilana Karp[1,2], Alyssa Casill[2], and Matthew J. Gamble[2]

[1]Stern College for Women, Yeshiva University, New York, NY; [2]Departments of Molecular Pharmacology and Cell Biology, Albert Einstein College of Medicine, Bronx, New York

Co-transcriptional, alternative splicing allows for multiple proteins to be coded from a single gene, greatly increasing the diversity of the proteome. Regulation of alternative splicing plays a crucial role in many biological processes and is often dysregulated in cancers. Cassette exon splicing, a specific type of alternative splicing, leads to the complete inclusion or exclusion of a specific exon. Alternative splicing outcomes are affected by multiple variables. Splicing rates play a leading role in determining the likelihood that a cassette exon will be included or excluded. However, RNA Pol II elongation rates have also been recently shown to affect alternative splicing outcomes. Under different elongation rates the transcribing polymerase will spend different amounts of time inside the window of opportunity, the region between the first and second 3' splice sites of the alternative event. It is during this time that an inclusion event is given a "head start" that can affect the overall proportion of transcript that will contain the cassette exon. If the window of opportunity is longer the alternative exon is more likely to be included, at a faster elongation rate the alternative exon is more likely to be excluded. Because splicing is co-transcriptional, at faster splicing rates the alternative exon is more likely to be included.

Our lab has developed an assay called SKaTER-seq (Splicing Kinetics and Transcript Elongation Rates through sequencing) which uses a computational pipeline to analyze nascent RNA-seq data and determine splicing and elongation rates genome-wide in mammalian cells. At the heart of the analysis pipeline is state model of transcription and co-transcriptional splicing which can simulate splicing outcomes under a set of defined rates. We used the SKaTER simulator to calculate the Percent Spliced In (PSI) value for a specific gene given splicing rates, elongation rate, initiation rates, termination rate, as well as the structure of the gene. Using this pipeline, we have explored the parameters that determine if an alternative splicing event will be regulated by elongation. These studies will allow us to predict the conditions that render an alternative splicing event elongation regulatable. The dysregulation of elongation-regulated splicing in cancers highlights the importance of these mechanistic studies for human health.

Sulfasalazine Increases the Abundance of Glucocorticoid Receptor Alpha in Mice

Tova Y. Lambert[1], Tiago D. Fernandes[2,3,4], Mabel N. Abraham[2,3,4], and Clifford S. Deutschman[2,3,4]

[1]Stern College for Women, Yeshiva University, New York, NY; [2]The Feinstein Institute for Medical Research, Manhasset, NY; [3]Hofstra-Northwell School of Medicine, Hempstead, NY; [4]Department of Pediatrics, Cohen Children's Medical Center, Northwell Health, New Hyde Park, NY

Background: Sepsis is a major cause of mortality and morbidity world-wide. The early phase of the disorder is characterized by excessive inflammation and cardiac depression. Glucocorticoids (GCs) are immunosuppressive and also enhance cardiac function. Therefore, GCs should be ideal in treating sepsis. However, clinical studies using GCs in septic patients have yielded inconsistent results (1). The effects of sepsis on the GC signal transduction pathway, and on GC receptors (GRs), have not been well studied. There are several GR isoforms. GR alpha (GRα) activates GC-mediated responses. In contrast, GR beta (GRβ) inhibits GC activity. Recent work using cecal ligation and puncture (CLP), a well-accepted murine model of sepsis, demonstrated decreased GRα and increased GRβ isoform abundance (2). These CLP-induced changes might explain why GCs are ineffective in sepsis. Further, an intervention to boost GRα abundance might be beneficial in sepsis. A previous study indicated that sulfasalazine (SSZ) increased GRα in an *in vitro* model (3). Based on this data, in preparation for studying SSZ following CLP, we examined the effects of SSZ *in vivo* in C57BL/6 mice.

Hypothesis: Sulfasalazine will increase the abundance of GRα in the heart, liver, and lungs of normal C57BL/6 mice.

Methods: C57BL/6 mice were intraperitoneally (IP) injected with 15mg/kg of SSZ dissolved in 10% dimethyl sulfoxide (DMSO). Control mice received DMSO only. Two studies were conducted. In the first, injections were repeated 24 and 48 hours after the initial dose. Mice were euthanized one hour after the last injection; heart, liver, and lung tissues were harvested; and protein was isolated. In a second study, mice received SSZ and vehicle injections as above and were euthanized at 6, 24, and 48hrs following the final injection. Heart, liver, and lung tissues were again harvested and protein isolated. In both experiments, 40μg of protein was subjected to polyacrylamide gel electrophoresis. Gels were transferred to membranes. Blots were probed with a primary antibody to GRα and a mouse anti-rabbit secondary antibody. GRα abundance was detected using ChemiDoc MP Imaging System (BioRad; Hercules, CA) and quantified using Image Lab (BioRad; Hercules, CA). Results for the first study were analyzed and statistical significance ($p < 0.05$) was determined using an unpaired t-test. The second study was analyzed and statistical significance ($p < 0.05$) was determined using one-way analysis of variance for repeated measures with Sidak's post-hoc correction.

Results: Fig. 1 Demonstrates that treatment with SSZ significantly increased GRα protein abundance in the heart and liver. No change was detected in the lungs.

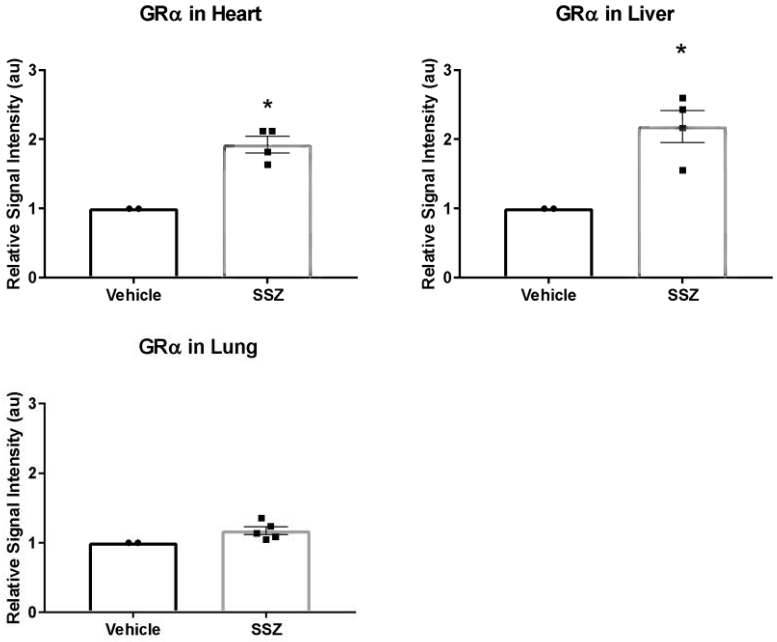

Figure 1.

We were unable to detect a significant increase in GRα abundance in the heart and liver at 6, 24, and 48 hours after the final SSZ dose was given. GRα abundance in the lung was significantly decreased at 24 hours and increased at 48 hours (Fig. 2).

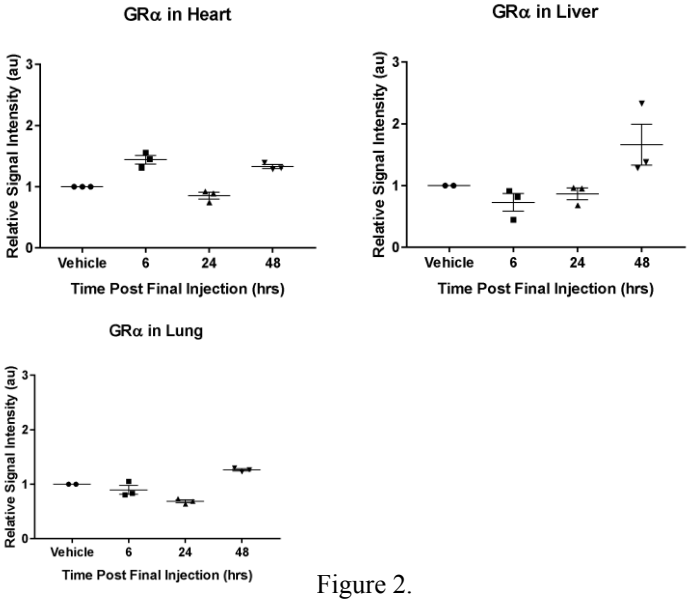

Figure 2.

Conclusion: Our findings indicate that SSZ treatment increased GRα abundance in the heart and liver one hour after the last dose. This effect was no longer apparent six hours later. GRα abundance in the lung increased at 48 hours. In future experiments we will determine

~ the time course of a single dose of SSZ and if it increases GRα one hour later

~ if SSZ increases GRα following CLP

~ if a SSZ-induced increase in GRα abundance increases GC activity

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Immuno-biomarkers: Detection and Prevention of Type 1 Diabetes

Alexandra Last[1] and Dr. Peter Gottlieb[2]

[1]Stern College for Women, Yeshiva University, New York, NY; [2] MD and PI of the Gottlieb Lab, Barbara Davis Center, Denver, CO

Type 1 diabetes is an autoimmune disease focused within the pancreas and its response to β cells within ones body. Those with Type 1 diabetes have difficulty and an inability to regulate glucose levels within their body and are seen to exhibit very few, and in most cases a lack of, β cells entirely. They experience sugar highs and lows, and experience extensive diabetic ketoacidosis, a condition caused by a lack of insulin within the body forcing it to produce high levels of ketones. As diabetes is a genetic disorder to some degree, family members will have their titers assessed throughout their life in order to check their antibody status against insulin. When their antibody status goes beyond 4 or 5, meaning that they their results display high levels of insulin resistant antibodies, the patient has a high probability of converting to Type 1 within the near future. Once they convert, their body goes through a honeymoon period where the body appears to be responding positively alongside its pancreas and β cells, and therefore patients have a minimal degree of maintenance. When the honeymoon period ends, there is a massive learning curve to try and ascertain exactly how to manage the diabetes and stabilize the body so that the individual can live a normal lifestyle without suffering the effects of the disease.

Diabetes is one of many diseases that has a large degree of uncertainty. It is variable in nature and therefore hard to understand how it can be prevented. It is a genetic disorder, yet you can have family members that never convert. It is often understood as seasonal and is witnessed to have a higher prevalence within the summer, yet is still very prominent throughout the rest of the year. On hypothesis is that there is something misaligned within the insulin, or something altered within its makeup and as a result the body rejects it; it sees it as a foreign entity and refuses to process or react to it. It is believed that the key to understanding, and eventually preventing diabetes is held within the exact nature of its autoimmunity.

The Immuno-biomarkers Study at the Barbara Davis Center, primarily focuses on the retrieval of T cells so that they can be plated and analyzed. This process consists of two steps: retrieval of PBMC's, peripheral blood mononuclear cells, which possess the lymphocytes, and an Elispot assay. The retrieval of PBMC's requires whole blood that is spun down, layered onto ficoll or an antifreeze, and spun down once more so that the Buffy Coat can emerge. Within the Buffy Coat reside the T cells which must be then isolated from the rest of the blood and plasma, washed out and suspended in PBS, phosphate buffered solution.

Once the PBMC's are retrieved they are used in the Elispot assay. This assay tests whether the cells will produce interferon, a cytokine, when stimulated by

peptide pools or HIPS, different combinations of “hybrid” insulin. If interferon is produced then this is an indication that those with diabetes are reacting to an altered insulin and producing antibodies against it. The assay begins with a two day incubation period of a 48 well plate, each well possessing the T cells, media and peptide pools or HIPS. It is then harvested and placed on a 96 well plate that has been coated and blocked with interferon. The last step of the assay requires the cells to be blown up by water, washed, and given a detector antibody and GABA, a signal that reacts with two activators so that the interferon may be visibly seen on the plate as white spots.

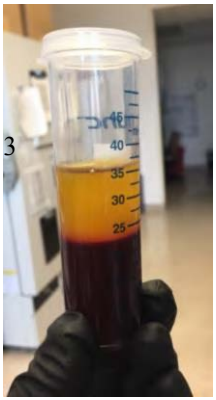

Figure 1: Whole blood spun down to separate plasma from blood, with the red blood cells sitting on the surface. Figure 2: Whole blood layered onto ficoll. Figure 3: The blood sample spun down to exhibit plasma on top, the Buffy coat layer below it (the dark gray layer), ficoll layer, and red blood cells on the bottom.

Although this study is in its initial stages, the impacts it can have on diabetes research are immense. This study and studies like it can be used to better understand the origins of diabetes, the bodies true reaction to insulin and through its analysis can aid in the eventual detection, prevention and potential eradication of Type 1 diabetes.

APOL1 Risk Allele Status of Hidradenitis Suppurativa

Miriam Temmeh Lattin[1,2], Lily Widdup[2], Elizabeth Binnse-Roemer[2], and Cheryl Winkler[2]

[1]Stern College for Women, Yeshiva University, New York, NY; [2] Molecular Genetic Epidemiology Studies Section, NCI-Frederick, Frederick, MD

Hidradenitis Suppurativa (HS) is a chronic inflammatory skin disease that occurs primarily in skin folds, characterized by recurrent painful abscesses and nodules, healing with substantial scarring. Treatment depends on disease severity, however, there is very limited data from randomized trials regarding treatment plans. In advanced cases, HS patients can have increased frequency of skin cancer. Epidemiological analyses of HS have shown higher incidence among African American individuals.

APOL1 Risk alleles (G1 and G2) are common in individuals with African ancestry, with 13% of African Americans carrying two risk alleles. Risk Allele carriers are protected against trypanosomes, while homozygous carriers have increased risk for severe kidney disease. Histological studies reveal increased frequency of CD163 macrophages in HS lesions, and APOL1 risk alleles have been associated with increased levels of CD163 macrophages as well.

We received tissue samples from 176 African American Hidradenitis Suppurativa patients, 70% female, 30% male from ages 14-76. We extracted DNA and genotyped for APOL1 using probes for 3 single nucleotide polymorphisms (SNPs) rs73885319, rs60910145, and rs71785313, the most common locations for APOL1 variations. Each sample was then genotyped via ABI Taqman Assay By Design using these probes. Water was used as negative controls.

Individuals were categorized as having 0, 1, or 2 risk alleles and the various haplotypes; WT, G1GM, G1G, and G2D6, were counted. With the results, we assessed Risk Allele frequency as compared to historic control of 13% in healthy African Americans.

Haplotype	Haplotype Count	Frequency seen	Literature controls (7)
WT	154	0.66	0.6
G1GM	54	0.23	0.22
G1G	3	0.013	0.015
G2D6	23	0.10	0.13

Table 1. Haplotype status for the 176 genotyped samples. Results fell within Hardy Weinberg, meaning that the frequency of each haplotype was the same as any randomized control group of African American individuals.

There does not seem to be any association between APOL1 mutations and Hidradenitis Suppurativa. Our results were limited due to smaller sample size, future studies should genotype a bigger sample size. Other diseases with CD163 macrophage associations may also be good candidates for APOL1 genotyping. Further stratification of the HS cohort, such as high-risk patients with later staged disease, may provide more information.

Deep Learning for Morphology-Based Subtyping of Brain Tumors

Marjorie C. Liebling[1], Gabriele Campanella[2], and Thomas J. Fuchs[2,3,4]

[1]Stern College for Women, Yeshiva University; [2]Department of Physiology, Biophysics, and Systems Biology Pathology, Weill Cornell Graduate School of Medical Sciences; [3]Department of Pathology, Memorial Sloan Kettering Cancer Center; [4] Department of Medical Physics, Memorial Sloan Kettering Cancer Center.

Cancer diagnosis is often based on recognizable differences in cellular morphology of detected tumors. However, in some instances - for example, when diagnosing brain tumors - even trained experts cannot differentiate between cancer subtypes based solely on morphology. The uncertainty that this process breeds often requires pathologists to turn to expensive, genetic sequencing of molecular markers to classify the tumor subtype. The use of high-capacity deep learning predictive models to analyze digital pathology slides could reveal features and representations that may allow for morphology-based classification of cancer subtypes, thereby enabling a more efficient and less expensive diagnosis process. In this study, we train an ensemble of three convolutional neural network (CNN) models to automate subtype classification of two brain tumors - Astrocytoma and Oligodendroglioma - on a dataset consisting of thirty two pathology images. The proposed models were trained with different strategies: (i) baseline tile extraction, (ii) nuclei classification based on all detected nuclei, and (iii) whole slide classification based on multiple instance learning (MIL).

Immunoglobulin Variable Light Chain Causes Amyloid Fibril Formation in SMA Protein

Tzivia Linfield[1,2], Hadassa Shaked[2], and Jordan Chill[2]

[1]Stern College for Women, Yeshiva University, New York, NY; [2]Department of Chemistry, Bar Ilan University, Ramat Gan, Israel

Systemic light chain amyloidosis (AL) is the most common form of amyloidosis. It occurs when immunoglobulin light chains (V_L), produced in the bone marrow, and released to the plasma, misfold and aggregate throughout the body, negatively affecting many internal organs. When misfolded, V_L chains form oligomers and fibrils; this aggregated form interacts with a variety of membranes, generating channels and pores that lead to cell toxicity.

SMA and LEN are homologous V_L chain proteins. SMA forms cytotoxic fibrils, while LEN does not. These proteins will serve as an experimental system to develop inhibitors for V_L chain aggregation, in order to reduce their concentration and toxicity. Our project focuses on cloning, expression, and purification of SMA and LEN.

The genes for LEN and SMA immunoglobulin V_L chains were inserted using G-block technology into a pET28 plasmid. They were then used to transform competent Escherichia Coli cells (BL21 strain). Cells were lysed using sonication and screened on SDS-PAGE for protein expression. Both LEN and SMA showed high expression as insoluble inclusion bodies. In order to transform this non-native form of the proteins to usable soluble V_L domains, the insoluble proteins were denatured using 8M urea and purified on a nickel affinity column. The eluted protein was then dialyzed against buffers containing decreasing concentrations of urea, gradually removing all urea and DTT. SDS-PAGE analysis confirmed about 10% of properly refolded protein. Size exclusion chromatography further confirmed the presence of properly folded monomers.

In order to encourage the protein to refold properly as soluble protein in cytoplasm of the bacterial cells, conditions for overnight induction were altered. Results showed minimal expression in the supernatant of the cells which were grown in Luria-Bertani Broth (LB) overnight at 16^{o}C with 0.05mM IPTG. The supernatant was then purified on nickel beads. SDS-PAGE of the purified protein showed very low expression. More conditions will be tested to encourage the protein to solubilize and express in the cytoplasm. Additional option is to express the folded protein in the periplasm of the cell by introducing a new vector with a signal peptide that encourages the protein to enter the periplasm, where it can easily be folded.

Once the protein is purified in higher amounts in its native fold, NMR spectroscopy will be used to better understand the structure of the V_L. Various

compounds will then be tested to determine the most effective way to develop a therapeutic treatment of systemic light chain amyloidosis.

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The Impact of Semantics and Exposure on Facial Recognition

[1]Talia Schiff, Elen-Sarrah Dolgopolskaia,[1] and Dr. David Anaki[2]

[1]Department of Psychology, Stern College for Women, Yeshiva University, New York, NY; [2]Gonda Multidisciplinary Brain Research Center, Bar Ilan University, Ramat Gan, Israel

Facial memory is the process by which faces are encoded and retrieved, in association with various portions of the brain including the Fusiform Face Area and other important areas in the temporal lobe. In analyzing the processes behind facial memory, we looked at the influence of factors like frequency of exposure to faces and the presence of semantic information, such as a given name or profession. Participants were recruited for a study consisting of four days of daily study and tests of 32 faces per day, varying in frequency of exposure (e.g., 0, 2, 4 times) and accompanying semantic information (e.g. Mike, Verizon Employee). The test asked participants to determine whether a given face was accompanied by semantic information and, if so, to identify it. The fifth day of the study consisted of a review of the 128 faces in preparation for the sixth day's final test, which also evaluated participants' ability to distinguish between previously and newly presented faces. During this final test, participants were evaluated both behaviorally, on performance accuracy, and electrophysiologically, through the use of event-related potential (ERP), consisting of electrodes in 72 locations across the scalp and face to provide a comprehensive picture of the electrophysiological activity occurring in the brain throughout the test. Another version of the experiment utilized fMRI imaging for the final test.

The behavioral results of the daily tests, as shown in Figure 1, demonstrated that increased exposure to faces made no difference in participants' recognition of faces when no semantic information was provided. However, when faces were accompanied by semantics, those faces exposed four times yielded better recognition, showing an interaction effect between the two independent variables. The lack of difference in recognition between the exposure conditions when semantics were not provided can be explained by the lesser challenge in simply remembering that no additional information was given. However, increased exposure did prove to be beneficial for the higher difficulty task of recognizing the faces with semantic information.

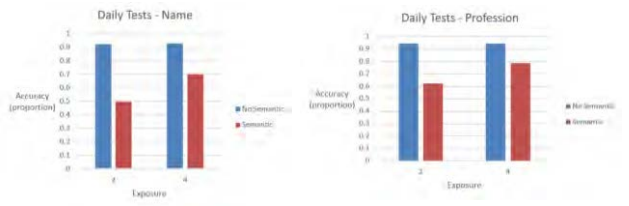


Figure 1. Behavioral results of daily tests, showing decreased performance with semantics and an increase in the semantic condition with four times exposure

The final test, as shown in Figure 2, looked not only at semantics and exposure, but also participants' ability to identify faces as previously learned or as new. The behavioral results showed trends similar to those of the daily tests for identifying semantics, however, accuracy identifying faces as old or new was higher for those which had originally been presented with semantics. Thus, although memory of the semantic information itself was not of high resolution, its attachment to faces during learning increased participants' familiarity with the faces, allowing them to identify those old faces with semantics with higher accuracy than those old faces without.

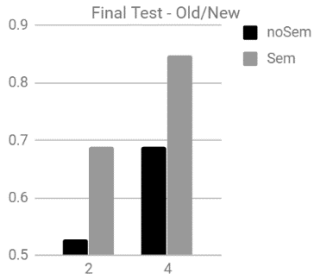


Figure 2. Behavioral results of final test show semantics increase ability to identify face as old

The behavioral data of the old/new question on the final test showed two main effects but no interaction effect, meaning both semantics and increased exposure increased recognition but increased exposure did not impact the influence of semantic information, and vice versa. This implies that both semantics and exposure affect face recognition, but based on different processes.

Using Brain Analyzer 2.0 software, performance on the final test was also analyzed through the use of ERP, which recorded all electrophysiological activity as it occurred. Figure 4 shows the cleaned and segmented data from the P10 electrode averaged across the four conditions and 16 participants. The zero-millisecond mark corresponds to the presentation of the picture, with the extreme negative dip at 170 milliseconds consistent with the brain wave pattern known to reflect the neural processing of faces, called the N170. The N170 of the four exposures with semantics showed stronger amplitudes than the other three conditions, showing two main effects with an interaction.

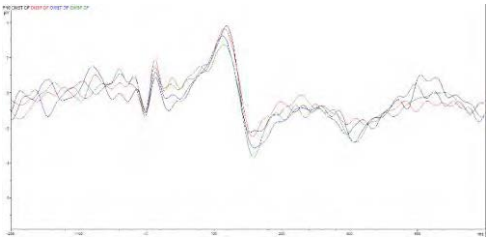


Figure 3. The four conditions as seen through the P10 electrode, averaged across 16 participants, showing the N170

These results have important ramifications for understanding and improving memory. For example, increased age is associated with a decrease in facial recollection, yet not in familiarity (i.e., remembering faces but not names) (Koen & Yonelinas, 2016). By understanding these two processes as distinct, it appears that attaching semantic information, such as name and personal details, to new faces benefits familiarity with faces even if not recollection of the names themselves.

The ATM Signaling Pathway Mediates Apoptosis in *sf3b1* Mutant Zebrafish

Elianna Sharvit[1,4], Sara Nik[2], and Teresa V. Bowman[2,3]

[1]Stern College for Women, Yeshiva University, New York NY; [2] Department of Developmental and Molecular Biology, Albert Einstein College of Medicine, Bronx NY; [3]Department of Medicine (Oncology) and Gottesman Institute for Stem Cell Biology and Regenerative Medicine; [4]Summer Undergraduate Research Program, Albert Einstein College of Medicine

The spliceosome is a large protein complex essential for regulating gene expression through the excision of introns from pre messenger RNA. Mutations in spliceosomal components have been implicated in an array of human diseases, including cancer. One of the most frequently mutated components is Splicing factor 3b, subunit 1 (SF3B1).

Using a zebrafish *sf3b1* loss-of-function model, previous studies have demonstrated that homozygous mutants exhibit severe DNA damage and apoptosis, especially in neural tissue. This indicates that an *sf3b1* loss-of-function mutation results in DNA damage. DNA damage can trigger several signaling pathways via the activation of distinct kinases, such as Ataxia Telangiectasia Mutated (ATM) in response to double strand breaks, and ATM and RAD3-related (ATR) in response to single strand breaks or replication stress. The specific signaling pathway that triggers cell death in *sf3b1* mutants remains unknown. Levels of phosphorylated Checkpoint Kinase 2 (Chk2), a direct substrate of the activated ATM kinase, are elevated in *sf3b1* mutants compared to their wild type siblings, suggesting that the ATM pathway is activated in response to the DNA damage caused by an *sf3b1* loss-of-function mutation.To determine if the ATM signal transduction pathway mediates the apoptotic phenotype in *sf3b1* mutants, an experiment was conducted using an ATM kinase inhibitor, which prevents the activation of the ATM pathway.

The embryos of a $sf3b1^{+/-}$ in-cross were treated at 6 hours post fertilization (hfp) with the ATM kinase inhibitor KU60019. Following fixation at 24 hpf, levels of apoptosis were assessed using immunofluorescent staining for the pro-apoptotic marker, active-Caspase 3. ATM kinase inhibitor treated *sf3b1* mutant zebrafish displayed less apoptosis than vehicle control treated mutants. This result indicates that ATM acts as a key mediator of apoptosis in *sf3b1* mutants. Taken together, these results suggest that ATM inhibition could be a novel therapeutic strategy for diseases involving SF3B1 mutations.

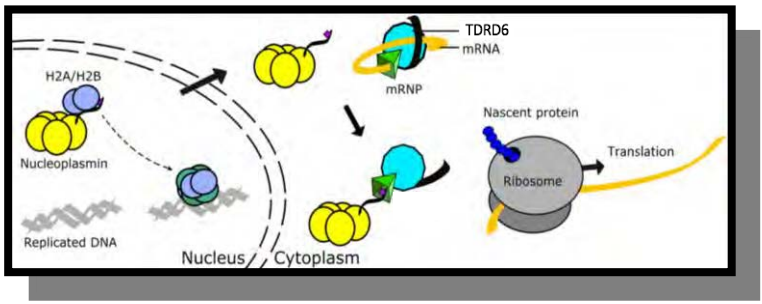
Future studies seek to further explore the role of the ATM pathway using $sf3b1^{-/-}$;$Chk2^{-/-}$ and $sf3b1^{-/-}$;$ATM^{-/-}$ genetic mutants. Additionally, they seek to explore the role of other DNA damage response pathways, such as the ATR pathway, using alternative kinase inhibitors. These studies may ultimately prove important for treating human diseases which result from mutations in SF3B1.

Interaction of TDRD6 and Arginine Methylated Nucleoplasmin Tail

Neda Shokrian[1], Benjamin Lorton[2], and David Shechter[2]

[1]Stern College for Women, Yeshiva University, New York, NY, [2]Department of Biochemistry, Albert Einstein College of Medicine, Bronx, NY, Summer Undergraduate Research Program

Cells must manufacture proteins in order to survive. The Central Dogma of biology states that DNA must undergo transcription in order to produce RNA, which is then translated into protein. During the cleavage stage of early embryogenesis in *Xenopus*, however, the zygotic genome is transcriptionally silent, i.e. no new RNA is synthesized from the zygotic genome. Yet, the newly fertilized egg cells still undergo numerous rapid rounds of DNA replication and division in the complete absence of zygotic gene products. This period is of development is under "maternal control"—explicitly governed by maternal factors (RNA, protein, and metabolites) which were deposited into the egg during oogenesis. In other words, newly translated proteins are derived only from maternal mRNA during the cleavage stage. Maternal control of development lasts until zygotic genome activation (ZGA) which occurs after the 12th cleavage in *Xenopus*, where after development is transferred to zygotic control.



Xenopus egg cells contain maternal messenger ribonucleoproteins (mRNP) particles that function to store maternal mRNA in a translationally repressed state. After fertilization, the mRNP particles are somehow remodeled to activate translation of their stored maternal transcripts, but how this occurs remains an open question. Amongst a handful of proteins comprising maternal mRNPs is TDRD6 (Tudor domain containing 6). TDRD6 contains six extended Tudor domains (eTUD) followed by a long, intrinsically disordered C-terminal tail. The role of TDRD6 in mRNPs is not well understood. Various Tudor domain proteins have been shown to interact with binding partners containing arginine-methylated motifs that interact with the Tudor domain's "aromatic cage," exemplified by the X-ray crystal structure of TDRD1 (another TDRD protein family member) in complex with an arginine-methylated E2F transcription factor peptide.

During the cleavage stage, histones must be released and deposited onto the rapidly replicating DNA to establish embryonic chromatin. Nucleoplasmin

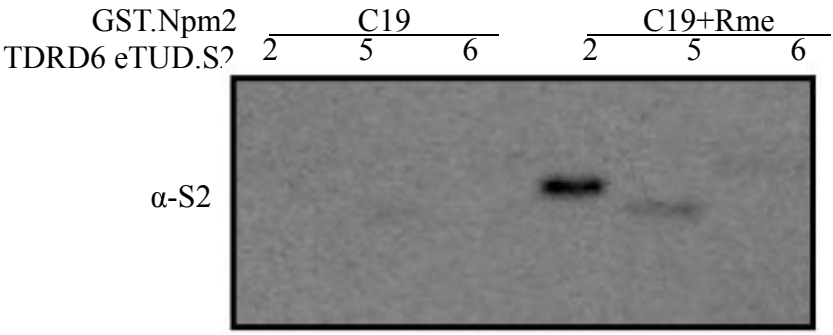
(Npm2) is the predominant storage chaperone for histones H2A and H2B in *Xenopus laevis* eggs. It has a pentameric form and is composed of a core domain and an intrinsically disordered C-terminal tail. Npm2 contains three acidic patches that are post-translationally modified, including phosphorylation and glutamylation, to promote histone binding. Over 90% of Npm2 is arginine methylated near the end of its C-terminal tail, yet a function for this methyl mark has not yet been described.

Comparing the sequences of the arginine-methylated motifs of both Npm2 and E2F revealed that Npm2 shares 100% identity with the binding motif of E2F in the TDRD1 structure. Furthermore, TDRD6 presence is highest in the oocyte and egg during early embryogenesis, but significantly decreases after ZGA. Therefore, we hypothesize that after release of its histone cargo, the Npm2 Rme C-terminal tail can interact with maternal mRNPs by binding one or more of the TDRD6 Tudor domains to de-repress the translational block of maternal mRNPs during early embryogenesis.

In this capacity, Npm2 would function as a developmental timer: release of histones from Npm2 marks the completion of S-phase and Npm2 binding TDRD6 signals protein expression and cell cleavage and progression to the next cell cycle. Our approach to test this hypothesis was to purify each individual TDRD6 Tudor domain and perform protein pulldown assays with the C-terminal 19 residues of the Npm2 tail with and without arginine methylation.

Results:
All 6 eTUDs (extended Tudor domains) expressed by E. coli bacteria were insoluble under non-denaturing conditions and could not be extracted by Nickel purification and stepwise dialysis. However, complete denaturation of all proteins using Urea and injection of the protein into NDSB folding buffer, followed by slow dialysis, produced a significant increase of soluble protein for eTUDs 2, 5, and 6, as shown by size exclusion chromatography.

The proteins of the remaining domains proved too insoluble to be purified, thus far. A binding assay of Npm2-C19 with and without Arginine methylation pulled down eTUDs 2 and 5, while 6 was inconclusive. However, upon further examination by Western blot using a Strep II tag primary antibody (present on all 3 eTUDs tested) showed that Npm2-C19 with Arginine methylation pulled down eTUDs 2, 5, and 6, while Npm2-C19 without Arginine methylation did not pull down any eTUDs. While further experiments must be done, a connection is now established between the binding of the eTUDs and the methylated Arginine residue of the Npm2 tail.



GST Pulldown

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Dynamics of Quantum Systems Described by Spin-1/2 Models

Aviva Shooman and Dr. Lea Santos

Department of Physics, Stern College for Women, Yeshiva University, New York, NY

Quantum Mechanics is the part of physics that studies electrons, photons, and other small particles. It is an intrinsic probabilistic theory. According to the Heisenberg principle, you can only either measure the velocity with absolute precision or the position of a particle but not both with infinite precision at the same time. Furthermore, any quantum object has both wave and particle properties.

Schrödinger proposed an equation, known as the time-dependent Schrödinger equation, that provides all the information we can get about a quantum system. The information is contained in the wave function, often represented by the Greek letter psi, Ψ. It describes the evolution of the system. When a quantum object propagates, it behaves as a wave. However, when we measure its position, the wave properties will cease to exist. We say that the wave function collapses. When measuring the position, the wave function collapses to a specific position and we lose information about momentum. Likewise, when measuring the momentum, we have no information about the position.

For systems where the potential is time-independent, we can separate the time-dependent Schrödinger equation into two equations, one being the time-independent Schrödinger equation. We use this equation to compute the energy levels of the system. In Quantum Mechanics, energy is discrete, meaning that each level has a unique energy measurement that is an integer multiple of the lowest energy level (referred to as ground state). The energy measurement for a given level is never 1.5 times or a fraction value of the ground state (much like the discrete energy levels of the atom).

Other properties of Quantum Mechanics include quantum superposition, and quantum entanglement. Quantum Superposition explains the ability for a particle to exist in two or more different states at the same time. All possible positions for a particle are encoded in its wave function. Quantum Entanglement is a quantum property that connects two particles regardless of the distance between them. The actions performed on one particle affect the other particle instantaneously even though the particles may be extremely far from each other.

All elementary particles have spins. Here we dealt with electrons (fermions) that have a half spin. Suppose we place a spin-1/2 particle in a magnetic field pointing down in the z-direction. The particle will be either anti-aligned or aligned with the field. These states are referred to as up-spins and down-spins in z, respectively. The three Pauli Matrices (shown below) are used to represent the Hamiltonian that describes the particle.

$$\sigma_1 = \sigma_x = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}; \sigma_2 = \sigma_y = \begin{pmatrix} 0 & -i \\ i & 0 \end{pmatrix}; \sigma_3 = \sigma_z = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}.$$

For a lattice system with more than one spin-1/2 particle, each one on a different site of the lattice, the Hamiltonian contains Pauli matrices that act on each site. To write the Hamiltonian in a matrix form, we need a basis. One that is often used consists of all permutations of up and down spins on each site and is known as site-basis. Using the Binomial Theorem of Combinatorics, we computed all the possibilities of up- and down-spins depending on the number of spins. For example, a chain with 4 sites and only 1 up-spin has 4 site-basis vectors, as shown below.

↑↓↓↓; ↓↑↓↓;↓↓↑↓;↓↓↓↑

In our research, we used the time-independent version of the Schrödinger equation to obtain the energy levels and corresponding eigenstates of the system. Using the properties of Linear Algebra, we obtained eigenstates (eigenvectors) and eigenvalues (discrete energy levels) by diagonalizing the Hamiltonian Matrix. For each energy level (eigenvalue) in a given system, there is a particular corresponding eigenstate. Each eigenstate is a superposition of several Site-Basis Vectors. With the eigenvalues and eigenstates, we study the evolution of the system in time.

Our spin-1/2 Hamiltonian models real physical systems. This summer research was theoretical. We used a computer to study spin-1/2 systems of different sizes and with different parameters. We modeled and computed many different types of systems using Mathematica software.

In Mathematica, we computed the eigenvalues and eigenvectors of the system. We made histograms with the eigenvalues, such as the one shown in Fig 1 below, which was obtained for a chain with 4 sites, 1 up-spin, and 3 down-spins. Depending on the parameters of the Hamiltonian, different shapes of the histograms are observed.

Then, we prepared the system with a single up-spin and L sites in a state where the up-spin was placed on the first site. We studied the evolution of the system numerically by computing the probability in time of finding the up-spin on any site of the chain. This is shown in the Fig 2 and Fig 3 below (1 represents up-spin and 0 represents down-spin). In Fig 2, L=4, while in Fig 3, L=20. Each curve gives the probability for finding the particle on a different site.

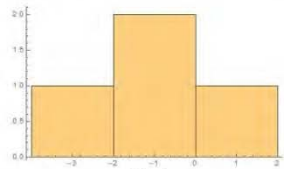

Fig. 1
Histogram model chain size 4

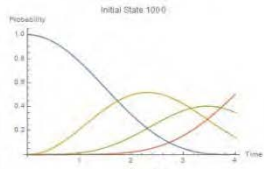

Fig. 2:
Initial State 1000,
chain of 4, 1 up-spin

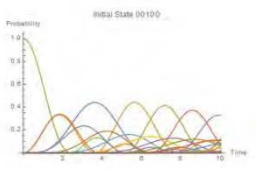

Fig. 3
Initial State 00100000...,
chain of 20, 1 up-spin

Our results show the remarkable property of quantum superposition. Initially, the up-spin can only be found on the first site of the chain. As time passes, there is a probability for it to be found on any site. It is as if it was on all sites at the same time. It is only when we perform a measurement, that the wave function collapses and the particle takes a stand.

Use of Genome Sequencing for Diagnosis of Rare Autism Spectrum Disorders

Rachel Somorov,[1] Sarah H. Elsea[2], and Stephen Williams[3]

[1]Stern College for Women, Yeshiva University, New York, NY; [2]Department of Molecular and Human Genetics, Baylor College of Medicine, Houston, TX; [3]10x Genomics, Inc., Pleasanton, CA; Genetics Internship Program

Background: Collectively rare diseases (RD) appear frequently in the population and the difficulty in diagnosing these conditions creates significant stress for afflicted individuals and their families. Though each RD, by definition, affects less than 200,000 Americans, with over 7,000 known RDs and approximately thirty million Americans and 350 million people globally impacted, this category of disease is hardly "rare". Obtaining the correct diagnosis is a challenge because most physicians do not recognize the combinations of symptoms. Additionally, many RDs do not have official diagnosis guidelines. On average, patients will see 7.3 physicians over 4.8 years between the time of symptom onset and official diagnosis [1]. Caring for a child with a developmental RD is a full-time job. Often in addition to arranging numerous doctors' appointments, parents also need to organize sessions with various therapists, nutritionists, and aids and maintain constant supervision of the child at home. The input of time, money, and energy especially without the direction of a diagnosis can easily wear a person out. With a diagnosis, patients can begin to contact the right specialists and finally gain some clarity about the disorder and access to treatment options if available, current research, and other resources such as support networks.

Introduction: Though our lab primarily focuses on Smith Magenis Syndrome (SMS), this study looked at non-SMS patients who struggled to obtain a diagnosis despite numerous genetic tests. SMS is a rare neurobehavioral disorder characterized by moderate mental retardation, sleep disturbance, obesity, and distinct physical features and behaviors caused by a deletion or mutation of the RAI1 gene on the chromosomal region 17p11.2. Our study looked at 20 patients who were originally referred to the lab for SMS diagnosis, as they presented with similar clinical features, but whose negative FISH results confirmatively ruled out that possibility. Many of these patients had undergone extensive genetic testing, systematically eliminating but not uncovering likely genetic disorders. Our study aimed to find accurate diagnoses by analyzing the patients' gene mutations obtained through full genome DNA sequencing.

Methods and Results: DNA samples were obtained using the Oragene OG-500 DNA saliva collection kits. Samples were sent to a genome sequencing company, 10X Genomics, for deep read sequencing with phasing. A unique electronic barcode was assigned to each DNA molecule which was then amplified using PCR. All the copies contained the same electronic barcode, allowing their sequences to be compared visually through a computer program called *igv*. This is what is known as a "deep read" (see figure 1). Consistency

within a deep read indicated high sequencing accuracy. “Phasing” informed the analyst about the parental origin of the single nucleotide polymorphism (SNP) (i.e. if it was inherited from the mother or father). Candidate SNPs were compared to known literature in ClinVar and OMIM to determine pattern of inheritance, pathogenicity and clinical relevance.

We began by looking at a sibling case, a brother and sister with moderate mental retardation whose parents were both normal. Many genetic disorders are caused by mutations which can be inherited or *de novo*. Since the chance of two normal parents having a child with a RD is very low (i.e. 1/25,000 births for SMS) and the likelihood of having two children is almost impossible ($1/25{,}000^2$) we looked for inherited mutations that were shared by both siblings starting with the recessive variants. Only three were identified and all were ruled out due to a phenotypic mismatch. Because the brother presented with a more severe phenotype, we next compared X chromosome variants reasoning that perhaps he had the full-blown mutation on his single X chromosome while his sister’s symptoms were less intense due to the compensation of a normal X chromosome. If this were true, it is likely that one parent also possessed the mutation without it being expressed, a case of reduced penetrance. However, none of the SNPs showed clinical relevance. The remaining steps will be to look for Autosomal dominant SNPs, possibly the result of mosaicism in a parent’s (likely the mother’s) cells or reduced penetrance. Once a promising SNP is identified, we will look at the corresponding region of the genome graphs on *igv* to rule out the possibility of a sequencing error.

Conclusion: We are confident that this approach will enable us to correctly diagnose these RD patients.

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Fig. 1 https://www.sciencedirect.com/science/article/pii/S2405852115000051 This is an example of a deep read in which each band represents a read, and SNPs are compared by moving down the reads vertically. In the center column, the reads consistently show a point mutation where Adenine appears instead of Cytosine, indicating high screening accuracy. This means the patient very likely possesses this mutation.

Exploring the Reliability of the NYC Subway System

Ayliana Teitelbaum[1], Akbar Mirza[2], Brian Hernandez[3], Amanda Rodriguez[4], Renzhentaxi Baerde[5], Phoebe Nguyen[6], Peter Farquharson[4], and Sasha Paulovich[8]

[1]Stern College for Women; [2]City College of New York; [3]Hunter College; [4]Lehman College, [5]Adelphi University; [6]Baruch College; [8]Fordham University, NY, NY

The New York City subway is the largest rapid transit system in the world, serving approximately 5.5 million riders each day. Recently there has been a growing concern over the state of the subway system due to aging equipment as reflected in system-wide metrics such as "on-time percentage", or how often trains run according to schedule. While these metrics provide some insight into the performance of the subway system, they fail to capture how riders experience the system.

In this project we use recently released countdown clock data that logs where each train is reported to be at each minute of the day to gain a better understanding of how riders experience the subway system. We examine rider wait times and trip times, considering not just average but also worst-case performance of the system. We also compare the subway to above ground travel, investigate how changes to the system affect rider options, and look at how commutes vary across demographic groups.

We find that the subway is typically quite reliable, but that averages can be misleading: variance in subway performance can account for up to a 50% difference between average and worst-case travel times (Figure 1). We also find a correlation between income and commute times (Figure 2) and that small changes to the system (e.g., adding or removing stops or lines) can have large effects on riders' options (Figures 3,4).

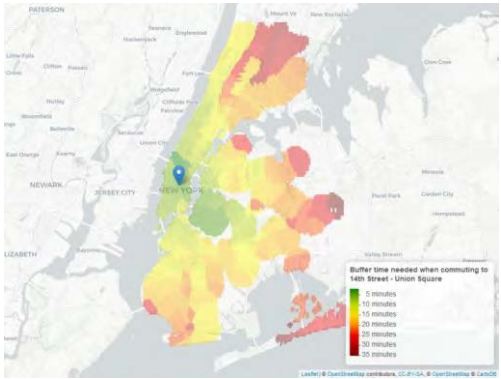

Figure 1. Difference between 90th percentile commute time and average commute time when commuting to 14th Street- Union Square.

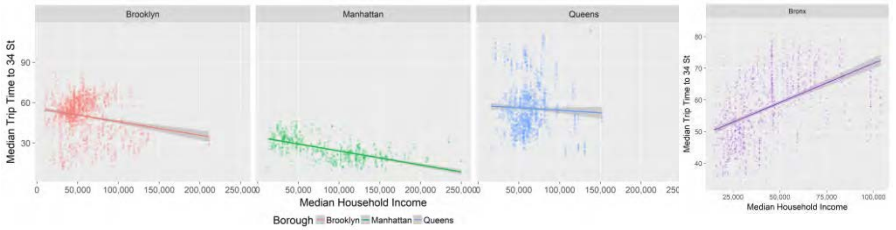

Figure 2. Correlation between median household income and commute time in different boroughs.

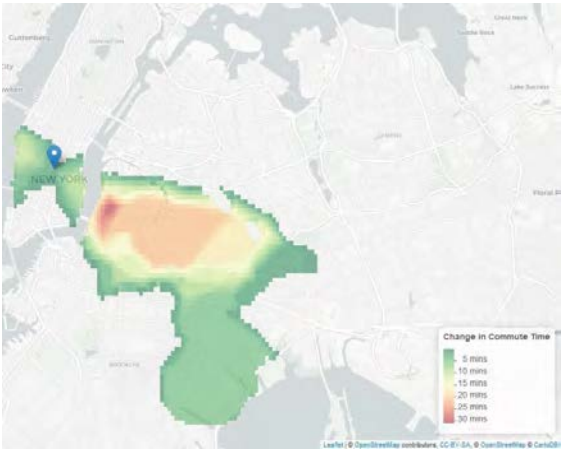

Figure 3. Change in commute time during L train shutdown.

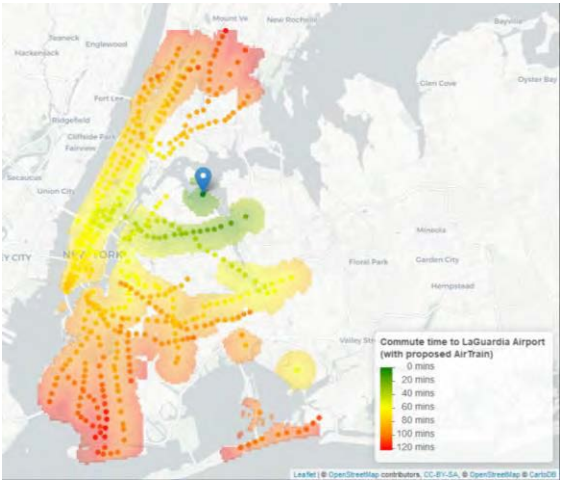

Figure 4. Commute time to LGA with proposed air -train LaGuardia.

Purification of LOXL1 and Compound Screening

Alexandra Tolmasov[1], Andras Varadi[2], and Konstantin Petrukhin[2]

[1]Stern College for Women, Yeshiva University, New York, NY; [2]Columbia University Medical Center, Department of Ophthalmology, New York, NY

Glaucoma is the leading cause of irreversible blindness worldwide. Exfoliation glaucoma (XFG) accounts for 25% of all glaucoma cases. XFG is caused by abnormal accumulation of microfibrillar material in the drainage system and other structures of the eye. The buildup of microfibrillar material increases the outflow resistance and causes pressure elevation in the eye that damages the optic nerve and causes vision loss. At certain stages of XFG increased expression of the enzyme lysyl oxidase-like 1 (LOXL1) is documented.

Lysyl oxidases are a family of copper-dependent enzymes that catalyze elastin and collagen crosslinking in ocular and other tissues. LOXL1 is the primary cross-linking enzyme for elastic fibers formation. We aimed to purify and use LOXL1 in compound screening experiments.
In order to express LOXL1 in mammalian cells, the coding region of the DNA that contained the LOXL1 gene had to be amplified. Through PCR amplification, epitope tags were engineered onto the DNA to facilitate the enzyme's purification. The DNA fragment and vector were ligated and introduced into E. coli cells. The plasmid DNA containing the LOXL1 gene was then extracted from E. coli cells and Chinese Hamster Ovary (CHO) cells were transfected with it to express LOXL1.

The culture media from the CHO cells containing LOXL1 was collected and purified by affinity chromatography. The culture media was loaded onto a column that contained nickel bound agarose beads that had an affinity for His tag. An imidazole-containing elution buffer was added to the column to elute LOXL1. The LOXL1 eluate was put into a pouch made of a semipermeable membrane and was dialyzed to remove imidazole that was in the buffers used for purification.

An unbiased compound screening was then conducted on the purified LOXL1 to identify potential LOXL1 inhibitors. Several randomly chosen compounds were diluted and added to wells on a 96-well black plate containing LOXL1. An enzyme activity assay was conducted and compounds that showed at least 50% inhibition of LOXL1 were then screened in a horseradish peroxide (HRP) activity assay to rule out HRP inhibition. The compounds that were not inhibiting HRP were classified as potential LOXL1 inhibitors.

Clotomics: The Stroke Genome Atlas

Esther Vidal[1,2], Christopher P. Kellner[2], Yonejung Yoon[2], and Dominic Nistal[2]

[1]Stern College for Women, Yeshiva University, New York, NY, 10016; [2]Icahn School of Medicine at Mount Sinai, New York, NY 10029

Background and Purpose:

The incidence of ischemic stroke in the United States is 3.3 per 1000 persons per year making it the leading cause of disability and fourth greatest causes mortality in the United States. Acute ischemic stroke (AIS) is a neurological condition caused by thrombotic or embolic occlusion of a cerebral artery and is characterized by the sudden loss of blood circulation to an area of the brain, resulting in a corresponding loss of neurologic function. For the last two decades, intravenous recombinant tissue plasminogen activator (t-PA), a medication that helps dissolve the clot quickly and restore blood flow to the brain tissue, was the standard treatment of care for AIS. Recently, endovascular therapy with mechanical thrombectomy has proven to be a significantly effective adjunct, as demonstrated by multiple randomized trials (MR CLEAN[1], ESCAPE[2], EXTEND IA[3], SWIFT PRIME[4], REVASCAT[5], THERAPY[6]), becoming the standard of care for AIS. While being remarkably beneficial for a subset of stroke patients, treatment for the vast majority of AIS patients has yet to be discovered. Despite ongoing research and revolutionary advancements in the field of AIS and intracerebral hemorrhage (ICH), clot biology in acute ischemic stroke is poorly understood. Initial studies on clot histology have provided a framework for clot analysis and suggest the possibility that clot composition can guide secondary stroke prevention and treatment in the acute setting. Based on the recently shown correlation between histology and performance of the mechanical thrombectomy devices and angiographic outcome, the question of whether or not clot composition ought to affect the selection of endovascular therapy was raised. The purpose of this ongoing study is to test whether the clot in acute ischemic stroke is an active, dynamic cellular environment with complex processes that can be studied, understood, and potentially targeted for new therapies.

Methods:

At the time of the thrombectomy, the retrieved clot will be divided into three tubes: two of which contain RNA preservatives and one formalin, for each type of processing. Cell processes that demonstrate active clot biology including cell division and intracellular communication will be analyzed. The transcriptome, proteome, and metabolomic data will be assessed for increased activity of mRNA previously acknowledged to be unregulated in these cellular activities. Additionally, patients found to have clots from cardioembolic origin will be compared to large artery atherosclerosis. This may be accomplished by cross-referencing lists of differentially expressed genes between the two groups with prior knowledge databases.

Results:
At our institution, approximately 50% of patients undergoing thrombectomy are treated within 3 hours with the remaining 50% treated greater than 3 hours from the onset of symptoms. The results of clot analysis will be compared between both groups to identify early and late gene products and metabolites. Similar analyses will also be done to identify putative group-specific biological processes. Whether each individual patient's clot is different and will require treatment specific to that individual will be explored as well. Genomic data will be compared between patients with cardioembolic sources and patients with large artery atheroembolic sources as well as patients with full recanalization with patients who had less than full recanalization.

Discussion:
Stroke is a devastating disease process that leaves individuals with lifelong disabilities or death. The findings in this study will allow us to better understand the pathophysiology of both ischemic and hemorrhagic stroke so that some of the greatest challenges in cerebrovascular disease can be addressed. Protein and RNA analysis will allow us to identify the anatomic origins of emboli immediately after the acute intervention is complete. DNA analysis will help to better understand why some patients respond different clinically when the procedural and radiologic outcomes are similar. These insights will allow for advances in stroke rehabilitation and primary and secondary stroke prevention.

Using MEG to Analyze Brain Activity Correlated with Counting and Number Recognition

Tzipora Weinberger[1], Yael Eisenberg[1], Ahmad Soleman[2], Amir Kleks[2], and Mina Teicher[2]

[1]Stern College for Women, Yeshiva University, New York, NY; [2]Department of Mathematics and Gonda Brain Research Center, Bar Ilan University, Ramat Gan, Israel

MEG (Magnetoencephalography) is a non-invasive neurophysiological technique that measures electromagnetic fields of the neuronal activity in the brain. Unlike other brain imaging devices such as the fMRI, PET and SPECT, the MEG has high temporal and spatial resolution, time scales in order of milliseconds and can directly measure brain function. Because of these differences, the MEG is able to clearly examine specific areas of the brain. Neurons on a cellular level have electrochemical properties that produce an outflow of charged ions. The net effect of this ionic current flow creates an electromagnetic field. However, there needs to be somewhere between fifty thousand to one hundred thousand excited neurons for the electromagnetic field to even produce a weak signal. Thus, the MEG machine needs superconducting sensors SQUID (superconducting quantum interference device) so that data can be collected. The SQUID sensors are immersed in a liquid helium cooling unit. Because of this temperature, impedance is low and the SQUID device can amplify magnetic fields created by neurons a few centimeters away from the sensors.

Earlier fMRI studies have demonstrated that there is no distinction in the brain when individuals see numbers in word or digit form. However, we are trying to pinpoint the part of the brain people use to count in small increments (from two to five). To do this, the participant is placed in the MEG machine and answers questions relating to numbers and counting. The screen first shows the participant two to five circles and they are asked to type how many there are. There is then a 0.7 break before the process starts again. In the next part the colors red blue and yellow are each assigned to a number. The participant is then shown a colored circle and has to indicate the number that correlates to the color. Both of these parts are repeated fifty times. In the final part the participant is shown a number from two to five and they have to indicate the digit. Because this is a part of the control it is done only ten times. The goal of this experiment is to analyze which sections of the brain light up when people see a digit as opposed to counting the number of objects. We predict that the participant's sensory/visual/ auditory area of the brain will react first and then the IPS (Intraparietal Sulcus) will be stimulated. Using PCA (Principal Component Analysis), we will analyze the data we got from the MEG machine to evaluate if this is true. While right now we are only trying to create a distinction between digits and counting, the ultimate goal of this is to find and differentiate the sections of the brain that people use to compute algebra and geometry questions.

The Purification of Human Recombinant Cytoglobin from *Escherichia coli*

Isabel Zats[1], Tapan Kundu[2] , Craig Hemann[2], and Jay Zweier[2]

[1]Stern College for Women, Yeshiva University, New York, NY; [2]Department of Internal Medicine, David Heart and Lung Institute, The Ohio State University College of Medicine, Columbus, OH, USA

Cytoglobin (Cygb) was discovered in 2001 as a fourth member of the globin family [1]. Human cytoglobin comprises of 190 amino acids with a molecular mass of 21.4 kDa and is encoded by a gene located on chromosome 17q25. It shares ~25% amino acid sequence homology with myoglobin (Mb) and hemoglobin (Hb), and ~15% homology with neuroglobin (Ngb). Typically globins consist of eight α-helical segments arranged in a characteristics 3-over-3 α-helical structure called "globin fold". Like other globins, Cygb also contains a heme prosthetic group called "iron protoporphyrin IX" in which Fe-atom is hexacoordinated with four equatorial N-atoms, one proximal (His113) and one distal (His81) histidine. The Fe-atom can reversibly bind small gaseous molecules such as oxygen (O_2), carbon monoxide (CO), and nitric oxide (NO). Cygb functions as an oxygen sensor in cell proliferation and oxygen diffusion for collagen synthesis during wound healing. It also regulates the blood pressure and vascular tone through its nitric oxide dioxygenase (NOD) activity [2]. The actual physiological role for this protein is still under investigation. Therefore, researchers are attempting to prepare more protein to conduct laboratory experiments to learn its functional roles. To do so, the protein has been overexpressed in *E. coli* cells.

The cDNA was cloned into pET17b expression vector bearing the human cytoglobin gene and the recombinant plasmid was transformed into chemically competent *E. coli* C41(DE3)pLysS strain using heat shock method. Cells containing the plasmid vector were selected by growing on Luria Broth (LB) agar plates containing 100 μg/mL ampicillin and 34 μg/mL chloramphenicol. Starter culture was prepared from an individual colony from the agar plate in 10 mL LB media containing the appropriate amount of selective antibiotics. Cells from the starter culture were then transferred into 1.5 L Terrific broth containing 0.2 g/L ampicillin and 34 mg/L chloramphenicol and grown at 37 ℃ with shaking at 180 rpm in a shaker-incubator. Once the optical density at 600 nm (OD_{600}) reached to ~0.9, the expression was supplemented with 0.5 mM of 5-aminolevulenic acid and was induced by addition of isopropyl-β-D-thiogalactoside (IPTG) to a final concentration of 0.5 mM. The culture was incubated for 18 additional hours at 30 ℃ with shaking at 150 rpm in a shaker-incubator. Cells were harvested by centrifugation at 4,000 rpm at 4 ℃ for 45 min using Beckman J-6B centrifuge. Cell pellets were frozen and stored at -80 ℃ for later use.

To extract the protein, we thawed 8.5g of cells and suspended them in a lysis buffer containing 20 mM potassium phosphate, 1 mM EDTA, protease inhibitor, DNase 1, and lysozyme (pH 7.8). The cells were then broken down

with sonication using the Branson Digital Sonifier. The cell extract was centrifuged to get rid of the cell debris and get the soluble extract of the protein. Heat treatment was then done to get rid of other protein impurities, followed by rapid cooling in ice cold water for ten minutes. The protein solution was then centrifuged again to get soluble extract. The supernatant containing the protein solution was then dialyzed against 2 L of 1 mM phosphate buffer (pH 7.0).

For further purification, we used FPLC and loaded the protein onto a Q-Sepharose FF column pre-equilibrated with 1 mM potassium phosphate buffer (pH 7.7) with 0.1 mM EDTA. The protein was eluted with the same buffer with (0-1 M) sodium chloride gradient. The active fractions were pooled, combined, and then concentrated using an Amicon 10 kDa molecular weight cut off (MWCO) concentrator. This concentrated protein was loaded into a size exclusion chromatography column, Sephacryl S-300, pre-equilibrated with 50 mM Tris-HCl buffer (pH 8.0) containing 1 mM EDTA and 100 mM sodium chloride. The protein was eluted using the same buffer, and the pure cytoglobin fractions were pooled, combined, and concentrated. The protein was quantified by the Bradford method using bovine serum albumin as a standard. From this prep, we got 28 mg of total cytoglobin. The purity of the protein was checked from its absorbance ratio (A_{417}/A_{280}) which was found to be ~2.0. The UV-visible spectrum of the oxidized Cygb shows a characteristic Soret band at 417 nm and the β and α Q-bands at 532 nm and 562 nm, respectively (Figure 1).

We similarly worked with overexpressed chemically competent cells that contained the strain BL21(DE3) b5R containing the plasmid vector pET100 bearing the human gene cytochrome b5 reductase as well.

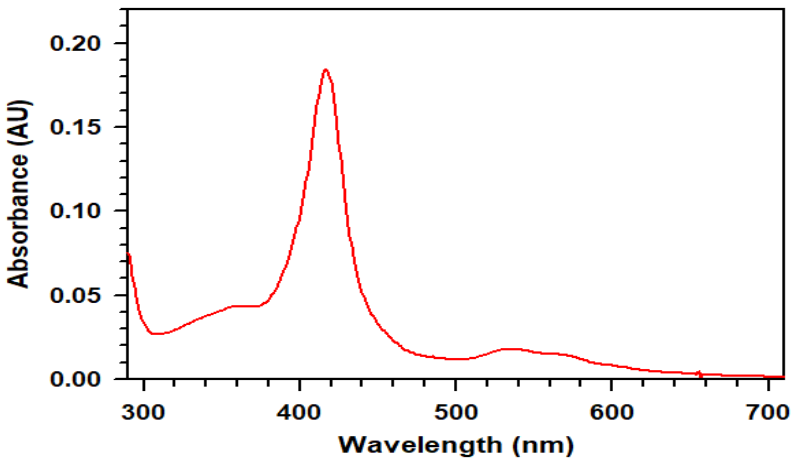

Figure 1: The UV-vis spectrum of human cytoglobin containing a characterstic Soret band at 417 nm together with the β and α bands at 532 and 562 nm, respectively which are charaterstics of hexacoordinated heme iron.

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